Chapter 8

Program lists and tree diagram

In this chapter, general descriptions of the application programs of *CReSS*, subroutines consisted the programs, include files and libraries of MPI will be described. The tree diagrams of the programs will be presented. Most descriptions are about the parallel version of *CReSS*. Since the serial version of *CReSS* is essentially the same as the parallel version, the readers will have no trouble with the descriptions even if they use the serial version.

Each source code of *CReSS* includes a single subroutine and each file has the same name as subroutine. This is helpful to read the source code as well as the tree diagram.

8.1 Program list

In this section, the programs of CReSS, the composing subroutines, include files and the library subroutine of MPI will be described.

8.1.1 Main programs of CReSS

 \pmb{CReSS} is composed of one solver (solver), two pre-processor (gridata and terrain) and one post-processor (gather) as listed below.

programs		description
solver	solver.exe	The solver program to perform the time integration from an initial value with boundary conditions.
gridata	gridata.exe	A pre-processor to produce an initial and boundary values for the solver by interpolating a grid point value to the grid points of the solver.
terrain	terrain.exe	A pre-processor to produce a model terrain data by interpolating of a topography data.
gather	gather.exe	A post-processor to combine multiple-output history files and/or the multiple terrain file in to a single file after parallel calculation.

8.1.2 List of subroutines

CReSS is composed of a few hundreds subroutines. All subroutines are listed below and their functions are described. Each subroutine file includes its corresponding subroutine. The names in the list will also refer to the file names.

subroutine	description
adjstnc	Adjust number density of ice phase to be consistent with mixing ratio.
adjstq	Adjust a negative mixing ratio to be zero.
advbsp	Calculate vertical advection term of the basic pressure field.
advbspt	Calculate vertical advection term of the basic potential temperature field.
advs	Calculate advection terms of scalar variables.
advuvw	Calculate advection terms of velocity vectors.
aggregat	Aggregation of number density of the ice phase.
baserho	Multiply Jacobian with the basic density.
bc8u	Calculate the boundary value defined at the points of u-velocity component.
bc8v	Calculate the boundary value defined at the points of v-velocity component.
bc8w	Calculate the boundary value defined at the points of w-velocity component.
bcbase	Calculate the boundary value of basic state variables.
bcdfbt	Calculate the upper and lower boundary values of the velocity deformation tensor.
bcphi	Calculate the boundary value of the Poison equation in the retrieval.
bcs2d	Calculate the boundary value of two-dimensional scalar variables.
bcsmsbt	Calculate the upper and lower boundary values for the 4th-order numerical smoothing
	terms of scalar variables.
bcsmssn	Calculate the south and north boundary values for the 4th-order numerical smoothing
	terms of scalar variables.
bcsmswe	Calculate the east and west boundary values for the 4th-order numerical smoothing
~ C DIII O II O	terms of scalar variables.

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subroutine	description
bcsmubt	Calculate the upper and lower boundary values for the 4th-order numerical smoothing
	terms of the x-component of velocity.
bcsmusn	Calculate the south and north boundary values for the 4th-order numerical smoothing
	terms of the x-component of velocity.
bcsmuwe	Calculate the east and west boundary values for the 4th-order numerical smoothing
	terms of the x-component of velocity.
bcsmvbt	Calculate the upper and lower boundary values for the 4th-order numerical smoothing
,	terms of the y-component of velocity.
bcsmvsn	Calculate the south and north boundary values for the 4th-order numerical smoothing
,	terms of the y-component of velocity.
bcsmvwe	Calculate the east and west boundary values for the 4th-order numerical smoothing
1 1.	terms of the y-component of velocity.
bcsmwbt	Calculate the upper and lower boundary values for the 4th-order numerical smoothing
haamran	terms of the vertical velocity component. Calculate the south and north boundary values for the 4th-order numerical smoothing
bcsmwsn	terms of the vertical velocity component.
bcsmwwe	Calculate the east and west boundary values for the 4th-order numerical smoothing
DCSIIIwwe	terms of the vertical velocity component.
bruntv	Calculation of the buoyancy frequency.
buoytke	Calculation of the buoyancy term in the equation of the turbulent kinetic energy.
buoywb	Calculation of the buoyancy term in the equation of the turbulent kinetic energy. Calculation of the buoyancy term in the time integration of the large time step.
buoyws	Calculation of the buoyancy term in the time integration of the small time step.
cast1d	Broadcast the horizontally uniform data (the interpolated sounding data).
castra	Broadcast the boundary values.
castname	Broadcast the namelist variables.
chkfile	Check the configuration of calculation when the restart files are read in.
chkitr	Check conversion of the mass conservation model.
chkmoist	Check if the experiment is moist or dry.
chkopen	Check if a history file with the same extension is opened.
chksedim	Check if the terms of sedimentation of hydrometeors are calculated at the same time
	intervals.
closedmp	Close history files.
cloudamt	Calculation of cloud amount.
cloudphy	The main driver routine of the cloud micro-physics.
cnt2phy	Conversion of the vertical velocity component in the calculation coordinate to that in
1 0	the physical coordinate.
coldrain	The driver routine of the bulk cold rain.
collc2r	Collision term between the cloud water and rain water.
collect	Collection terms between the hydrometeors including ice phase.
convc2r	Conversion term from the cloud water to rain water.
convers	Conversion terms between the hydrometeors including ice phase.
сору	Copy array variables to another array with the same dimension.
coriuv	Coriolis forces acting on the horizontal velocity components.
coriuvw	Coriolis forces acting on the all velocity components.
cpondall	Timing adjustment between the all processing elements.
currpe	Get the processing element number of the processing point in the calculation domain
	in the pre-processors.
deposit	Deposition term of hydrometeors.
destroy	Error processing in calculation.
dfomten	Calculate the deformation tensor.
diabat	Adiabatic term in the pressure equation.

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subroutine	description
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diffequa	Solve the poison equation in the retrieval.
disptke	Dissipation term of the equation of the turbulent kinetic energy.
diver2d	Calculate the horizontal divergence.
diver3d	Calculate the 3 dimensional divergence.
diverpe	Calculate the divergence term of the pressure equation in HE-VE scheme.
diverpih	Calculate the horizontal divergence term of the pressure equation in HE-VI scheme.
diverpiv	Calculate the vertical divergence term of the pressure equation in HE-VI scheme.
eddyvs1	Calculate the eddy viscous coefficient and the turbulent mixing length with respect to velocity.
eddyvs2	Calculate the eddy viscous coefficients of the scalar variables.
eddyvsfc	Calculate the eddy viscous coefficients of the vertical diffusion in the PBL process.
endmpi	Termination of MPI process.
estimpg	Calculate the production term of graupel and shading term.
evapr2v	Evaporation from rain water.
exbcsb	Forcing the boundary value of scalar variables to the boundary data in the large time
	step.
exbcss	Forcing the boundary value of scalar variables to the boundary data in the small time
	step.
exbcu	Forcing the boundary value of the x-component of velocity to the boundary data.
exbcv	Forcing the boundary value of the y-component of velocity to the boundary data.
exbcw	Forcing the boundary value of the vertical component of velocity to the boundary data.
exchansn	Exchange data in the y-direction between the neighboring processing elements.
exchanwe	Exchange data in the x-direction between the neighboring processing elements.
findrij	Calculate real array indexes of the model grids in the data domain.
fituvwc	Adjustment of velocity in order to satisfy the mass conservation.
fltret	Asselin filter of scalar variables in retrieval.
forcep	Driver routine of the advection and forcing terms of pressure perturbation.
forcept	Driver routine of the advection and forcing terms of potential temperature perturba-
Torcept	tion.
forceq	Driver routine of the advection and forcing terms of mixing ratios of liquid water
•	substances.
forceqv	Driver routine of the advection and forcing terms of mixing ratio of water vapor.
forceuvw	Driver routine of the advection and forcing terms of velocity.
freezing	Calculate the freezing term of rain water.
g2kg	Convert the unit of mixing ratios of water substances from [g kg ⁻¹] to [kg kg ⁻¹].
gaussel	The Gaussian elimination in HE-VI.
getbase1	Extract the base state which satisfies the hydrostatic balance from the external data
geobasei	in the data domain.
getbase2	Extract the base state which satisfies the hydrostatic balance from the external data
gctbabcz	in the model domain.
get chame	Get a namelist variable of character type.
getcname getdate	Get a character variable of yyyymmddhhmm from model time in the ssssss form.
-	Diagnostic calculation of the number density of ice when it is not prognostic.
getdianc	Exper function.
getexner	
getiname	Get a namelist variable of integer type.
getindx	Get a range of array index in the model domain to interpolate the external data.
getmxn	Find the maximum and minimum values of prognostic variables in the model domain.
getpt0	Set the initial perturbations of the potential temperature.
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getref	Calculate horizontally averaged reference potential temperature.
	Calculate horizontally averaged reference potential temperature. Get a namelist variable of real type. Calculate the reference density at the surface.

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subroutine	description
gettime	Find the model time.
gettrn	Set the model terrain.
getunit	Get the I/O number of file.
getxy	Calculate independent variable of the horizontal coordinate x, y of model grid.
getz	Calculate independent variable of the vertical coordinate ζ of model grid.
gridry	Main driver program of the pre-processor <i>gridata</i> . The Causa Saidal scheme in the time integration of HE VI
gseidel	The Gauss-Seidel scheme in the time integration of HE-VI.
gthdrv	Main driver program of the pre-processor gather. The driver routine of HE-VE.
heve hevi	The driver routine of HE-VE. The driver routine of HE-VI.
hint2d	Interpolate 2 dimensional data to the model grid.
hint3d	Interpolate 3 dimensional data to the model grid.
hndmore0	Adjust total of terms to decrease each mixing ratio.
inichar	Initialize character variables with space.
inimpi	Initialize MPI process and parameters of parallel processing.(solver)
inipe	Initialize MPI process and parameters of parallel processing.(pre-processor)
inisfc	Initialize variables of the surface process.
iniunit	Initialize table of I/O (set from 11 to 64).
inivar	Driver routine to initialize the prognostic variables.
intgdrv	Driver routine of the time integration.
intrpdrv	Driver routine to interpolate data into model grid in the pre-processor gridata.
jacobian	Calculate Jacobian and its components z, x and z, y .
kg2g	Convert unit of water substance from $[kg kg^{-1}]$ to $[g kg^{-1}]$.
lbcss	Calculate the lateral boundary values of the pressure perturbation.
lbcsb	Calculate the lateral boundary values of scalar variables except pressure.
lbcu	Calculate the lateral boundary values of the x-component of velocity.
lbcv	Calculate the lateral boundary values of the y-component of velocity.
lbcw	Calculate the lateral boundary values of the z-component of velocity.
112xy	Calculate the coordinate number x, y of longitude and latitude.
lspdmp	Relaxation coefficient of the lateral sponge layer.
lspht	Interpolate the model terrain in order to be linked smoothly with the terrain of outer
-	data in the lateral sponge layer.
lsps	Lateral boundary forcing of scalar variables in the sponge layer.
lspuvw	Lateral boundary forcing of vector variables in the sponge layer.
mapfct	Calculate the map factor.
melting	Melting terms of solid water substance.
move2d	Perform the coordinate movement.
newcold	Post process of the potential temperature perturbation, mixing ratios and number
	densities after the microphysical process.
nuclet11	Nucleation due to deposition.
nuclet12	Nucleation due to condensation freezing, contact freezing and immersion freezing.
nuclet2	The secondary nucleation.
nudges	Nudging scalar variables.
nudgeuvw	Nudging vector variables.
numchar	Count character number of a character variables.
opendmp	Open the history files.
\mathtt{outdmp}	Drive routine to output the history file.
outdmp2d	Output 2 dimensional variables to the history files.
outdmp3d	Output 3 dimensional variables to the history files.
outexbc	Output the lateral boundary values to the lateral boundary files.
outgeo	Output the geographical data (altitude of terrain, longitude and latitude).

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subroutine	description
outgrd	Output 3 dimensional grid point values to the grid data files.
outmxn	Output maximum and minimum values of prognostic variables to the standard output.
outpre2d	Output 2 dimensional external data.
outres	Output the prognostic variables to the re-start files.
outsfc	Driver routine to output the variables of the surface process to the history files.
outstd1	Output execution status to the standard output. No.1.
outstd2	Output execution status to the standard output. No.2.
outstd3	Output execution status to the standard output. No.3.
outstd4	Output execution status to the standard output. No.4.
outstd5	Output execution status to the standard output. No.5.
outstd6	Output execution status to the standard output. No.6.
outstd7	Output execution status to the standard output. No.7.
outstd8	Output execution status to the standard output. No.8.
outstd9	Output execution status to the standard output. No.9.
outstd10	Output execution status to the standard output. No.10.
outstd11	Output execution status to the standard output. No.11.
pc2kg	Convert the relative humidity $[\%]$ to the water vapor mixing ratio $[kg kg^{-1}]$.
pgrad	Calculate the pressure gradient force.
pgradiv	Calculate the vertical pressure gradient force in HE-VI.
pgratio	Calculate the partition ratio of rain to snow and graupel.
phasev	Drive routine to calculate the phase velocity difference between the external data and
	prognostic data at the lateral boundary.
phasevbc	Drive routine to calculate the phase velocity difference between the external data and
	prognostic data at the lateral boundary.
phvbcs	Calculate the phase velocity of the difference between the external scalar data and
	prognostic scalar variables at the lateral boundary.
phvbcuvw	Calculate the phase velocity of the difference between the external velocity data and
	prognostic velocity at the lateral boundary.
phvs	Calculate the phase velocity of the prognostic scalar variables at the lateral boundary.
phvuvw	Calculate the phase velocity of the prognostic velocity at the lateral boundary.
phy2cnt	Calculate the contravariant velocities in the physical coordinates.
phycood	Calculate the coordinate values of z in the physical coordinates.
productg	Production rate of grouple.
putunit	Return the I/O unit number to the table of number after it is used.
radiat	Solar radiation and downward long wave radiation.
rdexbc	Read in lateral boundary values.
rdgrd	Read in 3-dimensional grid point data.
rdini	Read in 3-dimensional initial data.
rdname	Read in namelist variables.
rdobj	Read in 3-dimensional grid point values (in the pre-processor gridata). Users may
	change the statements to read in.
rdpre2d	Read in 2-dimensional data (for example, terrain data).
rdres	Read in the re-start files.
rdsnd	Read in the 1-dimensional sounding data.
rdstd	Input routine of the post-processor gather.
rdtrn	Read in the terrain data in the pre-processor terrain. Users may change the statement
	to read in.
resetag	Reset the tag of MPI function to zero.
retrvp	Main driver routine of the retrieval of the pressure perturbation.
retrvs	Main driver routine of the retrieval of scalar variables.
retrvuvw	Main driver routine of the retrieval of the velocity components.

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SWPZHAU ELACHANGE THE ATTAYS OF PROGRESSIO VARIABLES IN THE ORDER OF THINE.		
	DWPZIIAU	Exchange the arrays of prognostic variables in the order of time.

continued	
subroutine	description
armret	Exchange the arrays of scalar variables of the retrieval in the order of time.
swpret t2pt	Conversion of temperature to potential temperature.
timeflt	Asselin's time filter.
tkequa	The driver routine of 1.5th-order closure.
trilat	Coriolis parameter.
trndrv	Main driver routine of the pre-processor terrain.
turbdrv	Main driver routine of the turbulence process.
turbflx	Calculate the turbulent flux of scalar prognostic variables.
turbret	Driver routine of turbulent process of scalar variables in retrieval.
turbs	The turbulent terms (subgrid-scale process) of scalar prognostic variables.
turbsfc	The turbulent terms of vertical diffusion.
turbuvw	The turbulent terms (subgrid-scale process) of velocities.
var8uvw	Interpolate of variables at the velocity gird point.
vbcp	The top and bottom boundary condition of the pressure perturbation.
vbcpt	The top and bottom boundary condition of the perturbation of potential temperature
vbcsb	The top and bottom boundary condition of the mixing ratios.
vbcu	The top and bottom boundary condition of the x-component of velocity.
vbcv	The top and bottom boundary condition of the y-component of velocity.
vbcwp	The top and bottom boundary condition of the vertical velocity component.
vbcwc	The top and bottom boundary condition of the contravariant vertical velocity.
vint11d	Vertical interpolation of 1-dimensional data into 1-dimensional vertical fine gird.
vint13d	Vertical interpolation of 1-dimensional data into the model gird.
vint31d	Vertical interpolation of 3-dimensional data into 1-dimensional vertical fine gird.
vint33d	Vertical interpolation of 3-dimensional data into the model gird.
vspdmp	Calculate the dumping coefficients in the upper sponge layer.
vsps	Dumping process of the scalar variables in the upper sponge layer.
vspuvw	Dumping process of the velocity components in the upper sponge layer.
warmrain	The main driver routine of the bulk warm rain process.
xy211	Calculate the longitude and latitude from x, y coordinate.
xy2ij	Calculate the real array number of x, y coordinate.

8.1.3 list of include file

CReSS has two types of include files; one is common statement of Fortran and the other is namelist statement. There are also temporal include files which include array dimensions.

file name	description
$\mathtt{comdmp.h}$	Control parameters and common statement for history dump.
comindx.h	Indexes of the array of the namelist variables and their common statement.
commpi.h	Parameters and related common statement for MPI.
comname.h	Array of namelist variables and their common statement.
comstd.h	Control parameters and common statement for the standard I/O.
comunit.h	Array of the I/O unit number table and its common statement.
namelist.h	Namelist variables and their namelist statements.

8.1.4 MPI subroutines list

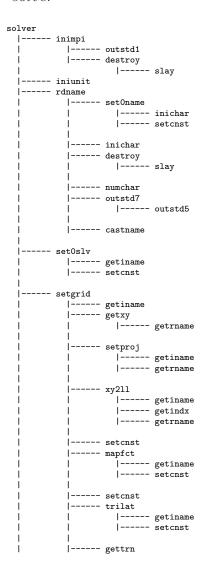
The program codes of $\it CReSS$ have MPI subroutines as well as the above subroutines. MPI subroutines used in $\it CReSS$ are listed in this subsection. The detailed description of MPI routine is found in the manuals of MPI.

subroutine	description
mpi_abort	Halt MPI processes.
mpi_allreduce	Perform the same process in all nodes.
mpi_barrier	Adjust timing between nodes.
mpi_bcast	Broadcast from a node to all nodes.
mpi_comm_rank	Get the number of node.
mpi_comm_size	Get a number of all nodes.
mpi_comm_split	Split communicator.
mpi_finalize	Terminate MPI.
mpi_gather	Gather data to a node from other nodes.
mpi_init	Initialize MPI.
mpi_sendrecv	Send and receive data simultaneously.
-	·

8.2 Tree diagrams of programs

In this section, tree diagrams of programs which are listed in Section8.1.1. Note that MPI library routines are not included in the diagram because they are not original to *CReSS*.

8.2.1 *solver*



```
|----- getiname
        ----- setcnst
        |----- rdpre2d
                  ----- inichar
                  |---- getcname
                  ----- getiname
                   ----- getunit
                          |----- destroy
                                     |---- slay
                  ----- outstd3
                          |----- outstd5
                  |
|----- destroy
| |----- slay
                  ----- setOname
                           |----- inichar
|----- setcnst
                     ---- chkfile
                          chkfile
|----- destroy
|----- slay
                 |----- putunit
|---- cpondall
        |---- exchanwe
                 |---- getiname
        |----- exchansn
| |----- getiname
       |---- bcs2d
                 |---- getiname
  --- outgeo
       |----- getrname
       |----- getcname
        |---- getunit
                |----- destroy
|----- slay
        |----- outstd3
                |----- outstd5
        |---- destroy
                 |---- slay
        |---- putunit
        ----- chkopen
                |----- destroy
                           |---- slay
       |---- cpondall
    - getz
       |---- getrname
     phycood
       |----- getiname
|----- getrname
       .
|----- сору
       ----- stretch
                 |----- getiname
                 |----- destroy
|----- slay
----- jacobian
       |---- getiname
        ----- exchanwe
                 |---- getiname
        |---- bc8u
                 |---- getiname
        |---- exchansn
                |---- getiname
       |---- bc8v
                 |---- getiname
       |---- var8uvw
                |---- getiname
                 |----- exchanwe
```

```
|---- getiname
                               -- bc8u
                                   |---- getiname
                              --- exchansn
                                   |---- getiname
                            ---- bc8v
                                   |---- getiname
                          |---- bc8w
                                   |---- getiname
                      -- exchanwe
                          |---- getiname
                |---- exchansn
                         |---- getiname
---- inivar
       |---- getiname
       |---- rdsnd
                |---- inichar
                |----- getcname
                |---- getunit
                        |----- destroy
|----- slay
                |----- outstd3
                        |----- outstd5
                |----- destroy
| |---- slay
                |----- putunit
|----- copy
|----- vint11d
              set1d
                |---- inichar
                |---- getcname
                |---- getrname
                |----- copy
|----- setcnst
                |---- destroy
       |---- move2d
                |---- getrname
       |----- cast1d
        ----- setbase
                |---- inichar
                |----- getcname
                 |---- exchanwe
                        |---- getiname
                 |---- bc8u
                         |---- getiname
                 |---- exchansn
                         |---- getiname
                  ----- bc8v
                         |---- getiname
                     --- vint13d
                        |---- getindx
                          |---- setcnst
                         |----- destroy
|----- slay
                |---- bcbase
       ----- baserho
                |---- var8uvw
                          |---- getiname
                          ----- exchanwe
                                   |---- getiname
                          |----- bc8u
                                   |---- getiname
                          ----- exchansn
                                  |----- getiname
```

```
|---- getiname
                    ----- bc8w
                           |---- getiname
     setvar1
        |---- сору
        ----- vbcu
                  |----- getiname
        |---- vbcv
                 |----- getiname
|----- getrname
        ----- vbcsb
                 |----- getiname
|----- getrname
        |---- getpt0
                  |----- getiname
|----- setcnst
                  |----- getrname
                           |---- getrname
                  .
|----- сору
                  ----- exchanwe
                           |---- getiname
                  |----- exchansn
| |----- getiname
                  |----- lbcsb
                           |----- getiname
|----- getrname
                     ---- vbcsb
                           |----- getiname
        |---- setcnst
---- rdres
        |---- inichar
        |---- getcname
        ----- getiname
        |---- getrname
        |---- getunit
               |----- destroy
        |----- outstd3
                 |----- outstd5
          ----- destroy
          ---- setOname
                  |----- inichar
         ----- chkfile
            |----- destroy
                          |---- slay
        |----- putunit
|---- cpondall
----- rdini
        |---- inichar
        ----- getcname
        ----- getiname
        ----- getunit
                |----- destroy
|----- slay
        |----- outstd3
                 |----- outstd5
        |----- destroy
| |----- slay
        |---- setOname
                 |---- inichar
                  ----- setcnst
        |---- chkfile
```

```
|---- destroy
                                            |---- slay
                        |----- putunit
                       ----- cpondall
                  -- chkmoist
                       |---- inichar
                       ----- getcname
                       |----- getiname
                         ----- 1bcu
                                 |----- getiname
|----- getrname
                       |----- lbcv
                                  |----- getiname
|----- getrname
                        |---- lbcw
                                   |----- getiname
|----- getrname
                          ---- phy2cnt
                                   |----- getiname
|----- copy
|----- vbcwc
                                             |---- getiname
                          ---- vbcu
                                  |----- getiname
|----- getrname
                          ---- vbcv
                                  |----- getiname
|----- getrname
                         ----- vbcwp
|----- getiname
                         ----- lbcss
                                  |---- getiname
                          ---- vbcp
                                  |----- getiname
                            --- lbcsb
                                  |----- getiname
|----- getrname
                             --- vbcsb
                                  |----- getiname
|----- getrname
                       |---- getdianc
                  -- exchanwe
                      |---- getiname
                    exchansn
                       |---- getiname
                    lspdmp
|----- getiname
                       |---- getrname
               ---- setsndbc
                      |----- castexbc
                ---- vspdmp
|----- getrname
                       |----- destroy
|----- slay
            ----- inisfc
                       |---- inichar
                       |----- Inichal
|----- getcname
|----- getiname
|----- getrname
|----- copy
           I---- sndwave
|---- outstd6
----- slvdrv
           |---- inichar
```

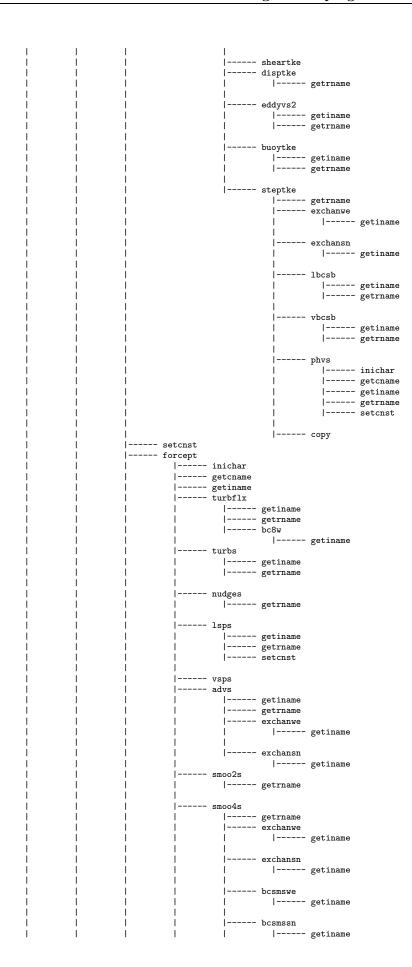
```
- getiname
----- getrname
   --- gettime
       |----- getiname
        |---- getrname
----- rdgrd
        |---- getrname
        ----- inichar
        |---- getcname
         |---- getiname
        ----- getunit
                 |----- destroy
|----- slay
         |----- outstd3
                 |----- outstd5
        |----- destroy
| |----- slay
        |----- setOname
| |----- inichar
                  ----- setcnst
        |
|----- chkfile
| |----- destroy
|----- slay
        ----- copndall
----- rdexbc
        |---- getrname
        ----- inichar
        |----- getcname
        ---- getunit
                 |----- destroy
|----- slay
         |----- outstd3
                 |----- outstd5
        |----- destroy
|----- slay
         |---- set0name
                  |---- inichar
                  ----- setcnst
         |---- chkfile
                  |----- destroy
|----- slay
        |----- putunit
|---- cpondall
        |----- castexbc
                  |---- getiname
      retrvuvw
         |---- getrname
         |---- phy2cnt
                 |----- getiname
|----- copy
                  |---- vbcwc
                            |---- getiname
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                  |----- getrname
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                   ----- exchanwe
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                            |---- getiname
                  ----- bclamb
             --- fituvwc
                   |---- getrname
                  |----- exchanwe
| |----- getiname
                   |---- exchansn
                           |---- getiname
                  |---- vbcwc
                            |---- getiname
```

```
cnt2phy
|---- getiname
|---- copy
    |---- сору
- retrvp
         --- getiname
    |---- getrname
     ----- forceuvw
              |---- inichar
              ---- getcname
              |---- getiname
              ----- exchanwe
                        |---- getiname
              |---- exchansn
                        |---- getiname
              |---- setcnst
              |---- turbdrv
                        |---- getiname
                         ----- phy2cnt
                                   |---- getiname
                                   |----- сору
                                   |----- vbcwc
                                             |---- getiname
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                                  |----- getiname
|----- getrname
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                         |----- eddyvs1
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|----- bc8u
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                           ---- strsten
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                              -- turbuvw
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                                   |----- getrname
                               - eddyvs2
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                                   |----- getrname
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                                   |---- getiname
                                    |---- turbflx
                                             |----- getiname
|----- getrname
|----- bc8w
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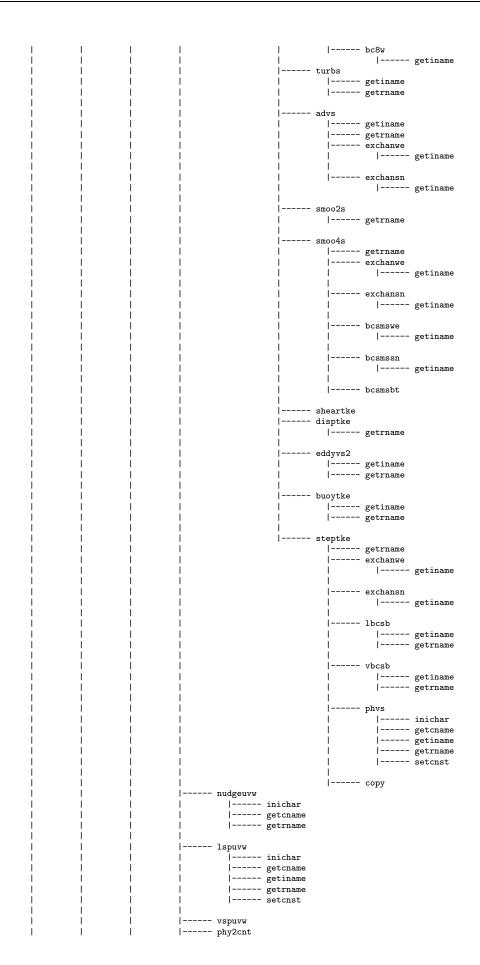
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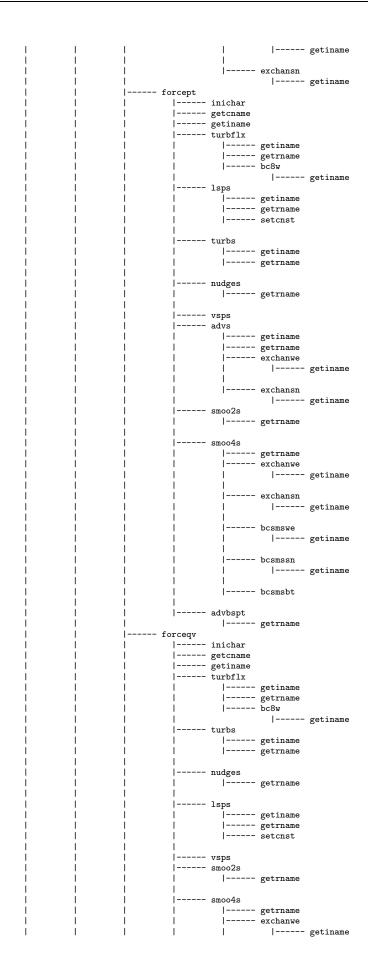
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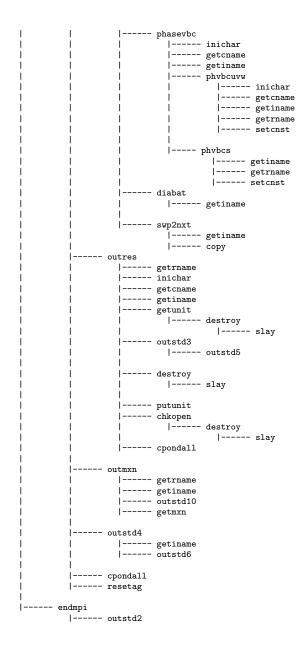
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8.2.2 *gridata*

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gridata
 |----- inipe
|----- outstd1
  |---- iniunit
  ----- rdname
           |---- setOname
                    |---- inichar
                     ----- setcnst
           |---- inichar
           |----- destroy
| |----- slay
            |---- numchar
            |----- outstd7
                     |----- outstd5
           |---- castname
   ----- set0grd
|----- inichar
           |----- getcname
  |----- getrname
                    |----- getiname
            ----- getxy |----- getrname
             ----- xy211
                    |----- getiname
|----- getindx
|----- getrname
             ----- getdate
                     |---- destroy
                              |---- slay
                 -- rdobj
                     |----- inichar
                     |----- getcname
                     ----- getunit
                            |----- destroy
                                       |---- slay
                     |----- outstd3
                              |----- outstd5
                     |----- destroy
| |----- slay
                     |----- putunit
            ----- t2pt
            ----- pc2kg
             ----- getbase1
                     |---- inichar
                     ---- getcname
                     ----- getref
                              |---- setcnst
                              ------ copy
                     |---- vint13d
                              |----- getindx
|----- setcnst
                              ----- destroy
                                       |---- slay
                     |----- destroy |----- slay
             ---- rotuvm2s
                     |----- getiname
```

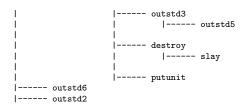
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rotuvs2m
       |----- getiname
   -- sparprt
----- currpe
----- setgrid
       |---- getiname
        ----- findrij
                 |----- getxy
| |---- getrname
                     --- xy211
                          |---- getiname
                           |----- getindx
|----- getrname
                 |---- getrname
                 |
|----- xy2ij
|----- getrname
|----- getindx
         ----- hint3d
                 |----- getiname
|----- getindx
                 |---- destroy
                         |---- slay
        |----- hint2d
                 |---- getiname
                 |---- getindx
                 ----- destroy
                         |----- slay
        |---- getxy
                 |---- getrname
         ----- gettrn
                 |---- getiname
                 |----- getrname
                 ----- rdpre2d
                           ----- inichar
                           |---- getcname
                           ----- getiname
                           |---- getunit
                                   |----- destroy
|----- slay
                            ----- outstd3
                                   |----- outstd5
                            ----- destroy
                                    |---- slay
                               --- setOname
                                   |----- inichar
                           |---- chkfile
                                   |---- destroy
                                             |---- slay
                           ----- putunit
                           |----- cpondall
                 |---- bcs2d
                          |---- getiname
         ----- lspht
                 |---- getiname
         ---- getz
                 |---- getrname
          ---- phycood
                 |---- getiname
                 |----- getrname
                 |----- copy
|---- stretch
|---- getiname
                           |---- getrname
                           |----- destroy
|----- slay
     getbase2
       |---- vint13d
```

```
|----- getindx
|---- setcnst
                  |----- destroy
|----- slay
   --- intrpdrv
        |---- inichar
        |----- getcname
        ----- findrij
                 |----- getxy
|----- getrname
                  |---- xy211
                          |---- getiname
                           |----- getindx
|----- getrname
                 ----- getrname
                 |----- xy2ij
|----- getrname
                           ----- getindx
        |---- bc8u
                 |---- getiname
         |----- hint3d
                 |----- getiname
                 |----- getindx
|----- destroy
                          |---- slay
        |---- vint33d
                 |----- getiname
                 |---- setcnst
        |----- bc8v
| |----- getiname
        |---- adjstq
----- outpre2d
        |----- inichar
        ---- getcname
        ----- getiname
        |---- getunit
               |----- destroy
        |----- outstd3
                 |----- outstd5
        |---- destroy
                |---- slay
        |----- putunit
      outgrd
        |---- inichar
        |---- getcname
         |---- getiname
        ----- getunit
               |----- destroy
|----- slay
        |----- outstd3
                |----- outstd5
        |
|----- destroy
| |----- slay
        |----- putunit
    -- outexbc
        |---- inichar
        ---- getcname
        |---- getiname
        |---- getunit
                |----- destroy
|----- slay
        |----- outstd3
                 |----- outstd5
        |---- destroy
```



8.2.3 *terrain*

```
terrain
 |---- inipe
          |----- outstd1
  ----- iniunit
  |---- rdname
          |----- setOname
| |----- inichar
                     ----- setcnst
            |---- inichar
            |----- destroy
| |----- slay
            |---- numchar
            |----- outstd7
                     |----- outstd5
            |---- castname
  |---- set0trn
           |---- setcnst
   ----- trndrv
            |---- setproj
                    |----- getiname
            |---- rdtrn
                      |---- getiname
                      ----- inichar
                      |---- getunit
                              - |----- destroy
                                        |---- slay
                           -- outstd3
                              |----- outstd5
                      |---- destroy
                              |---- slay
                      |----- putunit
              ---- currpe
             ----- findrij
                           --- getxy
|---- getrname
                      |---- xy211
                              |----- getiname
                               |---- getrname
                      ----- 112xy
                               |----- getiname
|----- getindx
|----- getrname
                      |----- xy2ij
|----- getrname
|----- getindx
            |---- hint2d
                     |----- getiname
|----- getindx
                     |----- destroy
|----- slay
            |----- outpre2d
                      |---- inichar
                      |----- getcname
                      |---- getunit
                             |----- destroy
|----- slay
```



8.2.4 *gather*

