SWAT

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Chapter 1

SWAT

An upgraded SWAT 2012 revision 670 code

Objectives

- Standard indentation and translation to Fortran 90 by using `findent`. See the translate-fortran90.pl perl script file (:heavy_check_mark:)
- Exhaustive use of the "implicit none" directive to detect bad variable usage (:heavy_check_mark:)
- Generate a GNU `Make` makefile and compile with GNU `GFortran`. See the gernerate-makefile.pl perl script file (:heavy_check_mark:)
- Remove non-used variables and format labels (:heavy_check_mark:)
- Detect and solve all uninitialized variables (:heavy_check_mark: :construction:, some proposed solutions could be incorrect)
- Remove unneeded variable initializations (:heavy_check_mark:) as:

  ```
  j=0 !  this line is not necessary
  j=ihru
  ```
- Remove redundant code (:heavy_check_mark:)
- Exhaustive use of the "parameter" directive on constants (:heavy_check_mark:)
- Remove global counters (as i, ihru, iihru, inum1 or idum in module parm). Using local counters or passing values as argument are preferred (:construction:)
- Generate a detailed list of issues detected in the original code (:heavy_check_mark:, see at the end of this README)
- Remove obsolete commented code (:x:)
- Update variable descriptions in comments (:construction:, a lot of work)
- Standardize comments by using Doxygen style in order to generate documentation. See at latex/refman.pdf (:construction:, a lot of work)

Required tools

- `GFortran` (to compile the source code)
- `Make` (to build the executable file)
- `Perl` (optional: to execute the perl scripts to update the makefile or to translate original files to Fortran 90)
- `Findent` (optional: to translate original files to Fortran 90 with a standard indentation)
- `Doxygen` (optional: to generate a reference programming manual from source code)
- `TeX Live` or `MiKTeX` (optional: to generate a reference programming manual from source code)
- On Microsoft Windows systems you have to install `MSYS2` and the required utilities (`GFortran` and `Make`). You can follow detailed instructions in `install-unix`

Instructions to generate Fortran 90 style code from original code

In order to generate Fortran 90 style code with standard indentation from original code you have to type on a UNIX type terminal (you need `Perl` and `Findent`):

$ perl translate-fortran90.pl

Instructions to generate an initial GNU make Makefile

Type on the UNIX type terminal, when translated the original code to Fortran 90 style (you need `Perl`):

$ perl generate-makefile.pl

Instructions to generate an executable to test

Type on the UNIX type terminal (you need `GFortran` and `Make`)

- In UNIX type operative systems:

  $ make

- In a `MSYS2` terminal in Microsoft Windows:

  $ EXE=".exe" LDFLAGS="-static" make

- Cross-compiling a 32 bits Microsoft Windows executable in a UNIX type operative system:

  $ prefix="i686-w64-mingw32-" EXE=".exe" LDFLAGS="-static" make

- Cross-compiling a 64 bits Microsoft Windows executable in a UNIX type operative system:

  $ prefix="x86_64-w64-mingw32-" EXE=".exe" LDFLAGS="-static" make

Instructions to generate an optimized executable file

Type on the UNIX type terminal (you need GFortran and Make)

- In UNIX type operative systems:

  $ CFLAGS="-march=native -flto" LDFLAGS="-flto" make strip

- In a MSYS2 terminal in Microsoft Windows:

  $ EXE=".exe" CFLAGS="-flto" LDFLAGS="-flto -static" make strip

- Cross-compiling a 32 bits Microsoft Windows executable in a UNIX type operative system:

  $ prefix="i686-w64-mingw32-" EXE=".exe" CFLAGS="-flto" LDFLAGS="-flto -static" make strip

- Cross-compiling a 64 bits Microsoft Windows executable in a UNIX type operative system:

  $ prefix="x86_64-w64-mingw32-" EXE=".exe" CFLAGS="-flto" LDFLAGS="-flto -static" make strip

Instructions to generate a reference programming manual from source code

Type on the UNIX type terminal (you need Doxygen and TeX Live or MiKTeX):

$ make latex/refman.pdf

The reference programming manual file latex/refman.pdf is generated from source code in PDF format

Issues in the original source code

This is a list of possible issues detected in the original source code. These issues have been mostly detected by the GFortran compiler warnings. Some of them could not arise because the logic of the variables is not possible.

- In biofilm.f:
  - `dcoef` is used but not initialized. `dcoef=3` as in watqual.f? Then, I propose at beginning: `real*8, parameter :: dcoef = 3.`
- In bmp_ri_pond.f:
  - `qseep` and `qet` could be used not initialized at lines 133 and 134. However the problem only arises for `nstep<1`
- In bmp_sand_filter.f:
  - `sed_removed` at line 342 could be used not initialized if `sfsedstdev<=0`
- In bpm_sed_pond.f:
  - `bmp_sed _pond` seems to be `bmp_sed_pond` at line 186
- In bmp_wet_pond.f:
  - `hvol` could be used not initialized in `ext_dpth` subroutine at line 267 in first bucle iteration

- In clicon.f:
  - `tmxbsb`, `tmnbsb`, `rbsb`, `rstpbsb`, `rhdbsb`, `rabsb`, `rmxbsb`, `daylbsb`, `fradbsb` and `u10bsb` could be used not initialized at 186-207 lines
- In conapply.f:
  - `k` and `kk` could be used not initialized at 121-122 lines if `iday_pest(j)/=ipst_freq(j)` and `curyr>nyskip`
- In confert.f:
  - `ifrt` seems to be `it` at line 214
- In curno.f:
  - `smxold` could be used not initialized if `cn1(h)<=1.e-6` and `curyr/=0` at line 96
- In drains.f:
  - `nlayer` could be used not initialized at line 23. However, the problem only arises if it is not set in the previous bucle (`mlyr<=1` or `sol_z(j1,j)<=0`)
- In etact.f:
  - `sev` could be used not initialized at line 286 if `dep>=esd` and `ly==2`
- In filter.f:
  - `remove21` seems to be `remove2` at line 316
- In grass_wway.f:
  - `sf_depth` and `sf_sed` could be used not initialized at lines 133 and 137 if `sf_area>0` and `sf↩_area<=1.e-6`
- In headout.f:
  - `hedr` array of column titles is written out of defined bounds at lines 118, 119, 121 and 133. It is written to `mrcho` (set to 62 in allocate_parms.f line 59) but in modparm.f the bound of `hedr` array is set to 46 (line 663)
- In hhnoqual.f:
  - `algon` seems to be `algcon` at line 190
- In hhwatqual.f
  - `orgnpin` seems to be `orgpin` at line 278
  - `thour=1.0` at line 377 overwrites previous `thour` calculation. It is wrong
- In hmeas.f:
  - `rhdbsb` could be used not initialized at line 84
- In hruaa.f:
  - `pdvas(70) = wtabelo` at line 249 but `wtabelo` is not initialized in any part of code
- In killop.f:
  - `ff1` and `ff2` are used but not initialized at lines 167 and 267. They are set in harvkillop.f file (lines 257-258). They have to be included in modparm.f to share harvkillop.f values? or they have to be redefined as in harvkillop.f?
- In NCsed_leach.f90:
  - `perc_clyr` could be used not initialized at line 221 if `sol_nly(j)<2`

- In nrain.f:
  - `no2pcp` seems to be `no3pcp` at line 72
- In pmeas.f:
  - `rbsb` could be used not initialized at line 143
  - `flag` could be used not initialized if ‘a==’ `'at line 210 -`rainsb`could be used not initialized, however only if`nstep<=0`
- In pminrl2.f:
  - at line 95 a comma is necessary between `base` and `vara`
  - `ssp` could be used not initialized at line 196 if `xx<=1.e-6`
- In pothole.f:
  - `solp_tileo` could be used not initialized at line 593 if `pot_vol(j)<=1.e-6` or `potvol_tile<=1.e-6`
- In potholehr.f:
  - `potflow` seems to be `potflwo` at line 447
- In readatmodep.f:
  - `momax=12*nbyr` is defined at line 65 but not used. It has to be `mo_max`? but then, it overwrites the file read
- In readops.f:
  - `year = 0.` seems to be `iyear = 0` at line 98
  - `mg13` seems to be `mgt13` at line 206
- In readpnd.f:
  - `vselsetlpnd` seems to be `velsetlpnd` at line 279
- In readru.f:
  - `tck` is used but not initialized at line 79
- In readsepticbz.f:
  - at line 135 `4.   e-8` seems to be `4.e-8`
- In rewind_init.f:
  - `orig_tnylda` is used but not initialized at line 174
- In routels.f:
  - `dstor` is used but not initialized at line 134. It has to be calculated as in watbal.f? or as in the commented line 109?
  - `latqout` and `gwqout` could be used not initialized at lines 142-143
- In rtbact.f:
  - `netwtr` could be used not initialized at line 124, however only if `nstep<1`
- In rthpest.f:
  - `thour=1.0` at line 183 overwrites previous `thour` calculation. It is wrong
  - `frsol` and `frsrb` could be used not initialized at lines 289-290 if `hrtwtr(ii)>0.001` and `hrtwtr(ii)/(idt*60)<=0.01`
- In rtpest.f:

  - `tday=1.0` at line 180 overwrites previous `tday` calculation. It is wrong

- In sched_mgt.f:
  - < = seems to be <= at 202 line
  - `husc` and `igrow` at lines 264-265 are used but not initialized. `husc` has to be `phu_op(iop,ihru)` has in readmgt.f? `igrow` has to be `igro(ihru)` has in readmgt.f?

- In smeas.f:
  - `rabsb` could be used not initialized at line 86

- In sweep.f:
  - `fr_curb` is used but not initialized at line 56. It has to be added to modparm.f to share result with sched_mgt.f? or it has to be `mgt5op(nop(ihru),ihru)` as in sched_mgt.f?

- In tmeas.f:
  - `tmxbsb` and `tmnbsb` could be used not initialized at lines 109-110

- In transfer.f:
  - `ratio`, `xx` and `ratio1` could be used not initialized at lines 236, 239 and 241 if `ihout==2`

- In wmeas.f:
  - `u10bsb` could be used not initialized at line 85

- In zero0.f:
  - `sol_sumn03` seems to be `sol_sumno3` at line 508

- In zero_urbn.f:
  - `stp_stagdis` seems to be `dtp_stagdis` at line 84
  - `subdr_kg` seems to be `subdr_km` at line 149
  - `spl_eros` is not defined at line 21, it could be `eros_spl`?

Chapter 2

Modules Index

2.1 Modules List

Here is a list of all documented modules with brief descriptions:

Chapter 3

File Index

3.1 File List

Here is a list of all documented files with brief descriptions:

Chapter 4

Module Documentation

4.1 parm Module Reference

main module containing the global variables

Variables

- integer, parameter mvaro = 33

  max number of variables routed through the reach
- integer, parameter mhruo = 79

  maximum number of variables written to HRU output file (output.hru) (none)
- integer, parameter mrcho = 62

  maximum number of variables written to reach output file (.rch) (none)
- integer, parameter msubo = 24

  maximum number of variables written to subbasin output file (output.sub) (none)
- integer, parameter mstdo = 113

  max number of variables summarized in output.std
- integer, parameter **motot** = 600
- character(len=80), parameter prog = "SWAT Sep 7 VER 2018/Rev 670"

  SWAT program header string (name and version)
- character(len=13), dimension(mhruo), parameter heds = (/" PRECIPmm"," SNOFALLmm"," SNOMELTmm"," IRRmm"," PETmm"," ETmm"," SW_INITmm"," SW_ENDmm"," PERCmm"," GW_RCHGmm"," DA_RCH↩Gmm"," REVAPmm"," SA_IRRmm"," DA_IRRmm"," SA_STmm"," DA_STmm","SURQ_GENmm","SURQ↩_CNTmm"," TLOSSmm"," LATQGENmm"," GW_Qmm"," WYLDmm"," DAILYCN"," TMP_AVdgC"," TMP_↩MXdgC"," TMP_MNdgC","SOL_TMPdgC","SOLARMJ/m2"," SYLDt/ha"," USLEt/ha","N_APPkg/ha","P_AP↩Pkg/ha","NAUTOkg/ha","PAUTOkg/ha"," NGRZkg/ha"," PGRZkg/ha","NCFRTkg/ha","PCFRTkg/ha","NRA↩INkg/ha"," NFIXkg/ha"," F-MNkg/ha"," A-MNkg/ha"," A-SNkg/ha"," F-MPkg/ha","AO-LPkg/ha"," L-APkg/ha"," A-SPkg/ha"," DNITkg/ha"," NUPkg/ha"," PUPkg/ha"," ORGNkg/ha"," ORGPkg/ha"," SEDPkg/ha","NSUR↩Qkg/ha","NLATQkg/ha"," NO3Lkg/ha","NO3GWkg/ha"," SOLPkg/ha"," P_GWkg/ha"," W_STRS"," TMP_S↩TRS"," N_STRS"," P_STRS"," BIOMt/ha"," LAI"," YLDt/ha"," BACTPct "," BACTLPct"," WTAB CLIm"," WT↩AB SOLm"," SNOmm"," CMUPkg/ha","CMTOTkg/ha"," QTILEmm"," TNO3kg/ha"," LNO3kg/ha"," GW_Q_↩Dmm"," LATQCNTmm"," TVAPkg/ha"/)

  column headers for HRU output file
- character(len=13), dimension(msubo), parameter hedb = (/" PRECIPmm"," SNOMELTmm"," PETmm"," E↩Tmm"," SWmm"," PERCmm"," SURQmm"," GW_Qmm"," WYLDmm"," SYLDt/ha"," ORGNkg/ha"," ORG↩Pkg/ha","NSURQkg/ha"," SOLPkg/ha"," SEDPkg/ha"," LAT Q(mm)","LATNO3kg/h","GWNO3kg/ha","CHO↩LAmic/L","CBODU mg/L"," DOXQ mg/L"," TNO3kg/ha"," QTILEmm"," TVAPkg/ha"/)

column headers for subbasin output file

- character(len=13), dimension(mrcho), parameter hedr = (/" FLOW_INcms"," FLOW_OUTcms"," EVAPcms"," TLOSScms"," SED_INtons"," SED_OUTtons"," SEDCONCmg/L"," ORGN_INkg"," ORGN_OUTkg"," ORG↩ P_INkg"," ORGP_OUTkg"," NO3_INkg"," NO3_OUTkg"," NH4_INkg"," NH4_OUTkg"," NO2_INkg"," NO2↩ _OUTkg"," MINP_INkg"," MINP_OUTkg"," CHLA_INkg"," CHLA_OUTkg"," CBOD_INkg"," CBOD_OUTkg"," DISOX_INkg"," DISOX_OUTkg"," SOLPST_INmg","SOLPST_OUTmg"," SORPST_INmg","SORPST_OU↩ Tmg"," REACTPSTmg"," VOLPSTmg"," SETTLPSTmg","RESUSP_PSTmg","DIFFUSEPSTmg","REACB↩ EDPSTmg"," BURYPSTmg"," BED_PSTmg"," BACTP_OUTct","BACTLP_OUTct"," CMETAL#1kg"," CME↩ TAL#2kg"," CMETAL#3kg"," TOT Nkg"," TOT Pkg"," NO3ConcMg/l"," WTMPdegc"," "," "," "," "," "," "," "," "," "," "," "," "," "," "/)

  column headers for reach output file

- character(len=13), dimension(41), parameter hedrsv = (/" VOLUMEm3"," FLOW_INcms"," FLOW_OU↩ Tcms"," PRECIPm3"," EVAPm3"," SEEPAGEm3"," SED_INtons"," SED_OUTtons"," SED_CONCppm"," ORGN_INkg"," ORGN_OUTkg"," RES_ORGNppm"," ORGP_INkg"," ORGP_OUTkg"," RES_ORGPppm"," NO3_INkg"," NO3_OUTkg"," RES_NO3ppm"," NO2_INkg"," NO2_OUTkg"," RES_NO2ppm"," NH3_I↩ Nkg"," NH3_OUTkg"," RES_NH3ppm"," MINP_INkg"," MINP_OUTkg"," RES_MINPppm"," CHLA_INkg"," CHLA_OUTkg","SECCHIDEPTHm"," PEST_INmg"," REACTPSTmg"," VOLPSTmg"," SETTLPSTmg","R↩ ESUSP_PSTmg","DIFFUSEPSTmg","REACBEDPSTmg"," BURYPSTmg"," PEST_OUTmg","PSTCNC↩ Wmg/m3","PSTCNCBmg/m3"/)

  column headers for reservoir output file

- character(len=13), dimension(40), parameter hedwtr = (/" PNDPCPmm"," PND_INmm","PSED_It/ha"," PNDEVPmm"," PNDSEPmm"," PND_OUTmm","PSED_Ot/ha"," PNDVOLm^3","PNDORGNppm"," P↩ NDNO3ppm","PNDORGPppm","PNDMINPppm","PNDCHLAppm"," PNDSECIm"," WETPCPmm"," W↩ ET_INmm","WSED_It/ha"," WETEVPmm"," WETSEPmm"," WET_OUTmm","WSED_Ot/ha"," WETVO↩ Lm^3","WETORGNppm"," WETNO3ppm","WETORGPppm","WETMINPppm","WETCHLAppm"," WETSE↩ CIm"," POTPCPmm"," POT_INmm","OSED_It/ha"," POTEVPmm"," POTSEPmm"," POT_OUTmm","OSE↩ D_Ot/ha"," POTVOLm^3"," POT_SAha","HRU_SURQmm","PLANT_ETmm"," SOIL_ETmm"/)

  column headers for HRU impoundment output file

- integer, dimension(mhruo), parameter icols = (/43,53,63,73,83,93,103,113,123,133,143,153,163,173,183,193,203,213,223,233

  space number for beginning of column in HRU output file (none)

- integer, dimension(msubo), parameter icolb = (/35,45,55,65,75,85,95,105,115,125,135,145,155,165,175,185,195,205,215,225

  space number for beginning of column in subbasin output file (none)

- integer, dimension(mrcho), parameter icolr = (/38,50,62,74,86,98,110,122,134,146,158,170,182,194,206,218,230,242,254,266

  space number for beginning of column in reach output file (none)

- integer, dimension(41), parameter icolrsv = (/38,50,62,74,86,98,110,122,134,146,158,170,182,194,206,218,230,242,254,266,2

  space number for beginning of column in reservoir output file (none)

- real ∗8, parameter ab = 0.02083

  lowest value al5 can have (mm H2O)

- integer, dimension(13), parameter **ndays_leap** = (/0,31,60,91,121,152,182,213,244,274,305,335,366/)
- integer, dimension(13), parameter **ndays_noleap** = (/0,31,59,90,120,151,181,212,243,273,304,334,365/)
- integer icalen

  code for writing out calendar day or julian day to output.rch, .sub, .hru files;
  icalen = 0 (print julian day), 1 (print month/day/year);
  icalen MUST be == zero if IPRINT == 3 to print subdaily

- real ∗8 prf_bsn

  Basinwide peak rate adjustment factor for sediment routing in the channel. Allows impact of peak flow rate on sediment routing and channel reshaping to be taken into account.

- real ∗8 **co2_x2**
- real ∗8 **co2_x**
- real ∗8, dimension(:), allocatable cdn

  denitrification exponential rate coefficient

- real ∗8, dimension(:), allocatable nperco

  nitrate percolation coefficient (0-1)
  0:concentration of nitrate in surface runoff is zero
  1:percolate has same concentration of nitrate as surface runoff

- real ∗8, dimension(:), allocatable surlag

  Surface runoff lag time. This parameter is needed in subbasins where the time of concentration is greater than 1 day. SURLAG is used to create a "storage" for surface runoff to allow the runoff to take longer than 1 day to reach the subbasin outlet (days)
- real ∗8, dimension(:), allocatable cmn

  rate factor for humus mineralization on active organic N
- real ∗8, dimension(:), allocatable phoskd

  phosphorus soil partitioning coefficient. Ratio of soluble phosphorus in surface layer attached to sediment to phosphorus dissolved in soil water
- real ∗8, dimension(:), allocatable psp

  phosphorus availibility index. The fraction of fertilizer P remaining in labile pool after initial rapid phase of P sorption (none)
- real ∗8, dimension(:), allocatable sdnco

  denitrification threshold: fraction of field capacity triggering denitrification
- real ∗8 r2adj_bsn

  basinwide retention parameter adjustment factor (greater than 1)
- real ∗8 pst_kg

  amount of pesticide applied to HRU (kg/ha)
- real ∗8 yield

  yield (dry weight) (kg)
- real ∗8 burn_frlb

  fraction of biomass and residue that burn(input in management file) range (0 - 1.0) (none)
- real ∗8 **yieldgrn**
- real ∗8 **yieldbms**
- real ∗8 **yieldtbr**
- real ∗8 **yieldn**
- real ∗8 **yieldp**
- real ∗8 **hi_bms**
- real ∗8 **hi_rsd**
- real ∗8 **yieldrsd**
- real ∗8, dimension(:,:), allocatable **hru_rufr**
- real ∗8, dimension(:,:), allocatable **daru_km**
- real ∗8, dimension(:,:), allocatable **ru_k**
- real ∗8, dimension(:,:), allocatable **ru_c**
- real ∗8, dimension(:,:), allocatable **ru_eiq**
- real ∗8, dimension(:,:), allocatable **ru_ovsl**
- real ∗8, dimension(:,:), allocatable **ru_a**
- real ∗8, dimension(:,:), allocatable **ru_ovs**
- real ∗8, dimension(:,:), allocatable **ru_ktc**
- real ∗8, dimension(:), allocatable **gwq_ru**
- real ∗8, dimension(:), allocatable **qdayout**
- integer, dimension(:), allocatable **ils2**
- integer, dimension(:), allocatable **ils2flag**
- integer ipest

  pesticide identification number from pest.dat (none)
- integer **iru**
- integer **mru**
- integer **irch**
- integer **isub**
- integer **mhyd_bsn**
- integer **ils_nofig**
- integer **mhru1**
- real ∗8 **wshd_sepno3**
- real ∗8 **wshd_sepnh3**

- real *8 **wshd_seporgn**
- real *8 **wshd_sepfon**
- real *8 **wshd_seporgp**
- real *8 **wshd_sepfop**
- real *8 **wshd_sepsolp**
- real *8 **wshd_sepbod**
- real *8 **wshd_sepmm**
- integer, dimension(:), allocatable **isep_hru**
- real *8 fixco

  nitrogen fixation coefficient
- real *8 nfixmx

  maximum daily n-fixation (kg/ha)
- real *8 res_stlr_co

  reservoir sediment settling coefficient
- real *8 rsd_covco

  residue cover factor for computing fraction of cover
- real *8 vcrit

  critical velocity
- real *8 wshd_snob

  average amount of water stored in snow at the beginning of the simulation for the entire watershed (mm H20)
- real *8 wshd_sw

  water in soil at beginning of simulation, or\ average amount of water stored in soil for the entire watershed, or\ difference between mass balance calculated from watershed averages and actual value for water in soil at end of simulation (goal is to have wshd_sw = 0.) (mm H2O)
- real *8 wshd_pndfr

  fraction of watershed area which drains into ponds (none)
- real *8 wshd_pndsed

  total amount of suspended sediment in ponds in the watershed (metric tons),
  or mass balance discrepancy for pond sediment expressed as loading per unit hectare of drainage area (metric tons/ha)
- real *8 wshd_pndv

  total volume of water in ponds in the watershed (m^3), or mass balance discrepancy for pond water volume expressed as depth over drainage area (mm H2O)
- real *8 percop

  pesticide percolation coefficient (0-1)
  0: concentration of pesticide in surface runoff is zero
  1: percolate has same concentration of pesticide as surface runoff
- real *8 wshd_resfr

  fraction of watershed area that drains into reservoirs (none)
- real *8 wshd_pndha

  watershed area in hectares which drains into ponds (ha)
- real *8 wshd_resha

  watershed area in hectares which drains into reservoirs (ha)
- real *8 wshd_fminp

  average annual amount of mineral P applied in watershed (kg P/ha)
- real *8 wshd_fnh3

  average annual amount of NH3-N applied in watershed (kg N/ha)
- real *8 wshd_fno3

  average annual amount of NO3-N applied in watershed (kg N/ha)
- real *8 wshd_forgn

  average annual amount of organic N applied in watershed (kg N/ha)
- real *8 wshd_ftotn

  average annual amount of N (mineral & organic) applied in watershed (kg N/ha)

- real ∗8 wshd_forgp

    average annual amount of organic P applied in watershed (kg P/ha)
- real ∗8 wshd_ftotp

    average annual amount of P (mineral & organic) applied in watershed (kg P/ha)
- real ∗8 wshd_yldn

    amount of nitrogen removed from soil in watershed in the yield (kg N/ha)
- real ∗8 wshd_yldp

    amount of phosphorus removed from soil in watershed in the yield (kg P/ha)
- real ∗8 wshd_fixn

    average annual amount of nitrogen added to plant biomass via fixation (kg N/ha)
- real ∗8 wshd_pup

    average annual amount of plant uptake of phosphorus (kg P/ha)
- real ∗8 wshd_nstrs

    average annual number of nitrogen stress units in watershed (stress units)
- real ∗8 wshd_pstrs

    average annual number of phosphorus stress units in watershed (stress units)
- real ∗8 wshd_tstrs

    average annual number of temperature stress units in watershed (stress units)
- real ∗8 wshd_wstrs

    average annual number of water stress units in watershed (stress units)
- real ∗8 **wshd_astrs**
- real ∗8 ffcb

    initial soil water content expressed as a fraction of field capacity
- real ∗8 wshd_dnit

    average annual amount of nitrogen lost from nitrate pool due to denitrification in watershed (kg N/ha)
- real ∗8 wshd_hmn

    average annual amount of nitrogen moving from active organic to nitrate pool in watershed (kg N/ha)
- real ∗8 wshd_hmp

    average annual amount of phosphorus moving from organic to labile pool in watershed (kg P/ha)
- real ∗8 wshd_rmn

    average annual amount of nitrogen moving from fresh organic (residue) to nitrate and active organic pools in watershed (kg N/ha)
- real ∗8 wshd_rwn

    average annual amount of nitrogen moving from active organic to stable organic pool in watershed (kg N/ha)
- real ∗8 wdpq

    die-off factor for persistent bacteria in soil solution (1/day)
- real ∗8 wshd_rmp

    average annual amount of phosphorus moving from fresh organic (residue) to labile and organic pools in watershed (kg P/ha)
- real ∗8 wshd_nitn

    average annual amount of nitrogen moving from the NH3 to the NO3 pool by nitrification in the watershe (kg N/ha)d
- real ∗8 wshd_voln

    average annual amount if nitrogen lost by ammonia volatilization in watershed (kg N/ha)
- real ∗8 wshd_pal

    average annual amount of phosphorus moving from labile mineral to active mineral pool in watershed (kg P/ha)
- real ∗8 wshd_pas

    average annual amount of phosphorus moving from active mineral to stable mineral pool in watershed (kg P/ha)
- real ∗8 wof_p

    fraction of persistent bacteria on foliage that is washed off by a rainfall event (none)
- real ∗8 wshd_raino3

    average annual amount of NO3 added to soil by rainfall in watershed (kg N/ha)

- real ∗8 wshd_plch

  average annual amount of phosphorus leached into second soil layer (kg P/ha)
- real ∗8 **ressedc**
- real ∗8 **basno3f**
- real ∗8 **basorgnf**
- real ∗8 **wshd_pinlet**
- real ∗8 **wshd_ptile**
- real ∗8 sftmp

  Snowfall temperature (deg C)
- real ∗8 smfmn

  Minimum melt rate for snow during year (Dec. 21) where deg C refers to the air temperature. (mm/deg C/day)
- real ∗8 smfmx

  Maximum melt rate for snow during year (June 21) where deg C refers to the air temperature. SMFMX and SM←↩ FMN allow the rate of snow melt to vary through the year. These parameters are accounting for the impact of soil temperature on snow melt. (mm/deg C/day)
- real ∗8 smtmp

  Snow melt base temperature. Mean air temperature at which snow melt will occur. (deg C)
- real ∗8 **basminpf**
- real ∗8 **basorgpf**
- real ∗8 wshd_ressed

  total amount of suspended sediment in reservoirs in the watershed (metric tons),
  or mass balance discrepancy for reservoir sediment expressed as loading per unit hectare of drainage area (metric tons/ha)
- real ∗8 wshd_resv

  total volume of water in all reservoirs in the watershed (m^3),
  or mass balance discrepancy for reservoir water volume expressed as depth over drainage area (mm H2O)
- real ∗8 basminpi

  average amount of phosphorus initially in the mineral P pool in watershed soil (kg P/ha)
- real ∗8 basno3i

  average amount of nitrogen initially in the nitrate pool in watershed soil (kg N/ha)
- real ∗8 basorgni

  average amount of nitrogen initially in the organic N pool in watershed soil (kg N/ha)
- real ∗8 basorgpi

  average amount of phosphorus initially in the organic P pool in watershed soil (kg P/ha)
- real ∗8 peakr

  peak runoff rate for the day in HRU or channel (m^3/s)
- real ∗8 albday

  albedo of ground for the day in HRU, the fraction of the solar radiation reflected at the soil surface back into space (none)
- real ∗8 pndsedin

  sediment inflow to the pond from HRU during day (metric tons)
- real ∗8 sw_excess

  amount of water stored in soil layer on the current day that exceeds field capacity (gravity drained water) (mm H2O)
- real ∗8 timp

  Snow pack temperature lag factor (0-1)
  1 = no lag (snow pack temp=current day air temp) as the lag factor goes to zero, the snow pack's temperature will be less influenced by the current day's air temperature.
- real ∗8 wt_shall

  shallow water table depth above the impervious layer (mm H2O)
- real ∗8 **sq_rto**
- real ∗8 qtile

  amount of water in drainage tile flow in HRU soil layer for the day (mm H2O)
- real ∗8 inflpcp

amount of precipitation that infiltrates into soil (enters soil) (mm H2O)

- real ∗8 fixn

  amount of nitrogen added to the plant biomass via fixation on the day in HRU (kg N/ha)
- real ∗8 latlyr

  amount of water in lateral flow in layer in HRU for the day (mm H2O)
- real ∗8 snofall

  amount of precipitation falling as freezing rain/snow on day in HRU (mm H2O)
- real ∗8 snomlt

  amount of water in snow melt for the day in HRU (mm H2O)
- real ∗8 tloss

  amount of water removed from surface runoff via transmission losses on day in HRU (mm H2O)
- real ∗8 **lpndloss**
- real ∗8 **lwetloss**
- real ∗8 bioday

  biomass generated on current day in HRU (kg)
- real ∗8 cfertn

  total amount of nitrogen applied to soil during continuous fertilizer operation in HRU on day (kg N/ha)
- real ∗8 cfertp

  amount of phosphorus applied to soil during continuous fertilizer operation in HRU on day (kg P/ha)
- real ∗8 fertn

  total amount of nitrogen applied to soil in HRU on day in fertilizer application (kg N/ha)
- real ∗8 sepday

  micropore percolation from bottom of the soil layer on day in HRU (mm H2O)
- real ∗8 sol_rd

  current rooting depth (mm)
- real ∗8 sedrch

  sediment transported out of channel or reach during time step (metric tons)
- real ∗8 **sepcrktot**
- real ∗8 **fertno3**
- real ∗8 **fertnh3**
- real ∗8 **fertorgn**
- real ∗8 **fertsolp**
- real ∗8 **fertorgp**
- real ∗8 qdfr

  fraction of water yield that is surface runoff (none)
- real ∗8 fertp

  total amount of phosphorus applied to soil in HRU on day in fertilizer application (kg P/ha)
- real ∗8 grazn

  amount of nitrogen added to soil in grazing on the day in HRU (kg N/ha)
- real ∗8 grazp

  amount of phosphorus added to soil in grazing on the day in HRU (kg P/ha)
- real ∗8 soxy

  saturation dissolved oxygen concentration (mg/L)
- real ∗8 rtwtr

  water leaving reach on day (m^3 H2O)
- real ∗8 sdti

  average flow rate in reach for day (m^3/s)
- real ∗8 **ressa**
- real ∗8 da_km

  area of the watershed in square kilometers (km^2)
- real ∗8 rchdep

depth of flow on day (m)

- real ∗8 rtevp

  evaporation from reach on day (m^3 H2O)
- real ∗8 rttime

  reach travel time (hour)
- real ∗8 rttlc

  transmission losses from reach on day (m^3 H2O)
- real ∗8 **resflwi**
- real ∗8 wdprch

  die-off factor for persistent bacteria in streams (1/day)
- real ∗8 **resflwo**
- real ∗8 **respcp**
- real ∗8 **resev**
- real ∗8 **ressep**
- real ∗8 **ressedi**
- real ∗8 **ressedo**
- real ∗8 pperco_bsn

  phosphorus percolation coefficient. Ratio of soluble phosphorus in surface to soluble phosphorus in percolate
- real ∗8 nperco_bsn

  basin nitrate percolation coefficient (0-1)
  0:concentration of nitrate in surface runoff is zero
  1:percolate has same concentration of nitrate as surface runoff
- real ∗8 rsdco

  residue decomposition coefficient. The fraction of residue which will decompose in a day assuming optimal moisture, temperature, C:N ratio, and C:P ratio
- real ∗8 voltot

  total volume of cracks expressed as depth per unit area (mm)
- real ∗8 **phoskd_bsn**
- real ∗8 msk_x

  weighting factor controling relative importance of inflow rate and outflow rate in determining storage on reach
- real ∗8 volcrmin

  minimum crack volume allowed in any soil layer (mm), or
  minimum soil volume in profile (mm)
- real ∗8 bactkdq

  bacteria soil partitioning coefficient. Ratio of solution bacteria in surface layer to solution bacteria in runoff soluble and sorbed phase in surface runoff.
- real ∗8 canev

  amount of water evaporated from canopy storage (mm H2O)
- real ∗8 precipday

  precipitation, or effective precipitation reaching soil surface, for the current day in HRU (mm H2O)
- real ∗8 uno3d

  plant nitrogen deficiency for day in HRU (kg N/ha)
- real ∗8 usle

  daily soil loss predicted with USLE equation (metric tons/ha)
- real ∗8 rcn

  concentration of nitrogen in the rainfall (mg/L)
- real ∗8 **surlag_bsn**
- real ∗8 thbact

  temperature adjustment factor for bacteria die-off/growth
- real ∗8 wlpq20

  overall rate change for less persistent bacteria in soil solution (1/day)
- real ∗8 wlps20

overall rate change for less persistent bacteria adsorbed to soil particles (1/day)

- real ∗8 wpq20

    overall rate change for persistent bacteria in soil solution (1/day)

- real ∗8 wps20

    overall rate change for persistent bacteria adsorbed to soil particles (1/day)

- real ∗8 bactrop

    persistent bacteria transported to main channel with surface runoff (# colonies/ha)

- real ∗8 bactsedp

    persistent bacteria transported with sediment in surface runoff (# colonies/ha)

- real ∗8 enratio

    enrichment ratio calculated for current day in HRU (none)

- real ∗8 pndpcp

    precipitation on pond during day (m^3 H2O)

- real ∗8 wetpcp

    precipitation on wetland for day (m^3 H2O)

- real ∗8 wetsep

    seepage from wetland bottom for day (m^3 H2O)

- real ∗8 pndev

    evaporation from pond on day (m^3 H2O)

- real ∗8 pndflwi

    volume of water flowing into pond on day (m^3 H2O)

- real ∗8 pndsedo

    sediment leaving pond during day (metric tons)

- real ∗8 pndsep

    seepage from pond on day (m^3 H2O)

- real ∗8 wetev

    evaporation from wetland for day (m^3 H2O)

- real ∗8 wetflwi

    volume of water flowing in wetland on day (m^3 H2O)

- real ∗8 wetsedo

    sediment loading from wetland for day (metric tons)

- real ∗8 da_ha

    drainage area of watershed in hectares (ha)

- real ∗8 pndflwo

    volume of water flowing out of pond on day (m^3 H2O)

- real ∗8 vpd

    vapor pressure deficit (kPa)

- real ∗8 wetflwo

    volume of water flowing out wetland on day (m^3 H2O)

- real ∗8 wetsedi

    sediment loading to wetland for day (metric tons)

- real ∗8 evlai

    leaf area index at which no evaporation occurs. This variable is used in ponded HRUs (eg rice) where evaporation from the water surface is restricted by the plant canopy cover. Evaporation from the water surface equals potential ET when LAI = 0 and decreased linearly to O when LAI = EVLAI

- real ∗8 evrch

    Reach evaporation adjustment factor. Evaporation from the reach is multiplied by EVRCH. This variable was created to limit the evaporation predicted in arid regions.

- real ∗8 wdlpf

    die-off factor for less persistent bacteria on foliage (1/day)

- real ∗8 ep_day

actual amount of transpiration that occurs on day in HRU (mm H2O)

- real ∗8 pet_day

  potential evapotranspiration on current day in HRU (mm H2O)
- real ∗8 bactrolp

  less persistent bacteria transported to main channel with surface runoff (# colonies/ha)
- real ∗8 bactsedlp

  less persistent bacteria transported with sediment in surface runoff (# colonies/ha)
- real ∗8 adj_pkr

  peak rate adjustment factor in the subbasin. Used in the MUSLE equation to account for impact of peak flow on erosion (none)
- real ∗8 n_updis

  nitrogen uptake distribution parameter. This parameter controls the amount of nitrogen removed from the different soil layer layers by the plant. In particular, this parameter allows the amount of nitrogen removed from the surface layer via plant uptake to be controlled. While the relationship between UBN and N removed from the surface layer is affected by the depth of the soil profile, in general, as UBN increases the amount of N removed from the surface layer relative to the amount removed from the entire profile increases
- real ∗8 nactfr

  nitrogen active pool fraction. The fraction of organic nitrogen in the active pool (none)
- real ∗8 p_updis

  phosphorus uptake distribution parameter This parameter controls the amount of phosphorus removed from the different soil layers by the plant. In particular, this parameter allows the amount of phosphorus removed from the surface layer via plant uptake to be controlled. While the relationship between UBP and P uptake from the surface layer is affected by the depth of the soil profile, in general, as UBP increases the amount of P removed from the surface layer relative to the amount removed from the entire profile increases
- real ∗8 snoev

  amount of water in snow lost through sublimation on current day in HRU (mm H2O)
- real ∗8 sno3up

  amount of nitrate moving upward in the soil profile in watershed (kg N/ha)
- real ∗8 reactw

  amount of pesticide in reach that is lost through reactions (mg pst)
- real ∗8 es_day

  actual amount of evaporation (soil et) that occurs on day in HRU (mm H2O)
- real ∗8 sdiegrolpq

  average annual change in the number of less persistent bacteria colonies in soil solution in watershed (# cfu/m^2)
- real ∗8 sdiegrolps

  average annual change in the number of less persistent bacteria colonies on soil particles in watershed (# cfu/m^2)
- real ∗8 sdiegropq

  average annual change in the number of persistent bacteria colonies in soil solution in watershed (# cfu/m^2)
- real ∗8 sdiegrops

  average annual change in the number of persistent bacteria colonies on soil particles in watershed (# cfu/m^2)
- real ∗8 wof_lp

  fraction for less persistent bacteria on foliage that is washed off by a rainfall event (none)
- real ∗8 ep_max

  maximum amount of transpiration (plant et) that can occur on day in HRU (mm H2O)
- real ∗8 sbactrolp

  average annual number of less persistent bacteria transported to main channel with surface runoff in solution (# colonies/ha)
- real ∗8 sbactrop

  average annual number of persistent bacteria transported to main channel with surface runoff in solution (# colonies/ha)
- real ∗8 sbactsedlp

  average annual number of less persistent bacteria transported with sediment in surface runoff (# colonies/ha)
- real ∗8 sbactsedp

average annual number of persistent bacteria transported with sediment in surface runoff (# colonies/ha)

- real ∗8 sbactlchlp

  average annual number of less persistent bacteria lost from soil surface layer by percolation (# cfu/m^2)

- real ∗8 sbactlchp

  average annual number of persistent bacteria lost from soil surface layer by percolation (# cfu/m^2)

- real ∗8 rchwtr

  water stored in reach at beginning of day (m^3 H2O)

- real ∗8 resuspst

  amount of pesticide moving from sediment to reach due to resuspension (mg pst)

- real ∗8 setlpst

  amount of pesticide moving from water to sediment due to settling (mg pst)

- real ∗8 **psp_bsn**
- real ∗8 bsprev

  surface runoff lagged from prior day of simulation (mm H2O)

- real ∗8 bssprev

  lateral flow lagged from prior day of simulation (mm H2O)

- real ∗8 spadyev

  average annual amount of water removed from potholes by evaporation in watershed (mm H2O)

- real ∗8 spadyo

  average annual amount of water released to main channel from potholes in watershed (mm H2O)

- real ∗8 spadyrfv

  average annual amount of precipitation on potholes in watershed (mm H2O)

- real ∗8 spadysp

  average annual amount of water removed from potholes by seepage in watershed (mm H2O)

- real ∗8 **spadyosp**
- real ∗8 qday

  amount of surface runoff loading to main channel from HRU on current day (includes effects of transmission losses) (mm H2O)

- real ∗8 al5

  fraction of total rainfall that occurs during 0.5h of highest intensity rain (none)

- real ∗8 no3pcp

  nitrate added to the soil in rainfall (kg N/ha)

- real ∗8 pndsedc

  net change in sediment in pond during day (metric tons)

- real ∗8 usle_ei

  USLE rainfall erosion index on day for HRU (100(ft-tn in)/(acre-hr))

- real ∗8 rcharea

  cross-sectional area of flow (m^2)

- real ∗8 volatpst

  amount of pesticide lost from reach by volatilization (mg pst)

- real ∗8 ubw

  water uptake distribution parameter. This parameter controls the amount of water removed from the different soil layers by the plant. In particular, this parameter allows the amount of water removed from the surface layer via plant uptake to be controlled. While the relationship between UBW and H2O removed from the surface layer is affected by the depth of the soil profile, in general, as UBW increases the amount of water removed from the surface layer relative to the amount removed from the entire profile increases

- real ∗8 uobn

  nitrogen uptake normalization parameter. This variable normalizes the nitrogen uptake so that the model can easily verify that upake from the different soil layers sums to 1.0

- real ∗8 uobp

  phosphorus uptake normalization parameter. This variable normalizes the phosphorus uptake so that the model can easily verify that uptake from the different soil layers sums to 1.0

- real ∗8 uobw

  water uptake normalization parameter. This variable normalizes the water uptake so that the model can easily verify that uptake from the different soil layers sums to 1.0
- real ∗8 wglpf

  growth factor for less persistent bacteria on foliage (1/day)
- real ∗8 wetsedc

  net change in sediment in wetland during day (metric tons)
- real ∗8 **respesti**
- real ∗8 rcor

  correction coefficient for generated rainfall to ensure that the annual means for generated and observed values are comparable (needed only if IDIST=1)
- real ∗8 rexp

  value of exponent for mixed exponential rainfall distribution (needed only if IDIST=1)
- real ∗8 snocov1

  1st shape parameter for snow cover equation. This parameter is determined by solving the equation for 50% snow cover
- real ∗8 snocov2

  2nd shape parameter for snow cover equation. This parameter is determined by solving the equation for 95% snow cover
- real ∗8 snocovmx

  Minimum snow water content that corresponds to 100% snow cover. If the snow water content is less than SNOC↩ OVMX, then a certain percentage of the ground will be bare (mm H2O)
- real ∗8 lyrtile

  drainage tile flow in soil layer for day in HRU (mm H2O)
- real ∗8 **lyrtilex**
- real ∗8 sno50cov

  Fraction of SNOCOVMX that corresponds to 50% snow cover. SWAT assumes a nonlinear relationship between snow water and snow cover.
- real ∗8 ai0

  ratio of chlorophyll-a to algal biomass (ug chla/mg alg)
- real ∗8 ai1

  fraction of algal biomass that is nitrogen (mg N/mg alg)
- real ∗8 ai2

  fraction of algal biomass that is phosphorus (mg P/mg alg)
- real ∗8 ai3

  the rate of oxygen production per unit of algal photosynthesis (mg O2/mg alg)
- real ∗8 ai4

  the rate of oxygen uptake per unit of algae respiration (mg O2/mg alg)
- real ∗8 ai5

  the rate of oxygen uptake per unit of NH3 nitrogen oxidation (mg O2/mg N)
- real ∗8 ai6

  the rate of oxygen uptake per unit of NO2 nitrogen oxidation (mg O2/mg N)
- real ∗8 rhoq

  algal respiration rate at 20 deg C (1/day or 1/hr)
- real ∗8 tfact

  fraction of solar radiation computed in the temperature heat balance that is photosynthetically active
- real ∗8 k_l

  half-saturation coefficient for light (MJ/(m2∗hr))
- real ∗8 k_n

  michaelis-menton half-saturation constant for nitrogen (mg N/L)
- real ∗8 k_p

  michaelis-menton half saturation constant for phosphorus (mg P/L)

- real ∗8 lambda0

  non-algal portion of the light extinction coefficient (1/m)
- real ∗8 lambda1

  linear algal self-shading coefficient (1/(m∗ug chla/L))
- real ∗8 lambda2

  nonlinear algal self-shading coefficient ((1/m)(ug chla/L)∗∗(-2/3))
- real ∗8 mumax

  maximum specific algal growth rate at 20 deg C(1/day or 1/hr)
- real ∗8 p_n

  algal preference factor for ammonia
- real ∗8 rnum1

  variable to hold value for rnum1s(:) (none)
- real ∗8 etday

  actual evapotranspiration occuring on day in HRU (mm H2O)
- real ∗8 auton

  amount of nitrogen applied in auto-fert application (kg N/ha)
- real ∗8 autop

  amount of phosphorus applied in auto-fert application (kg P/ha)
- real ∗8 hmntl

  amount of nitrogen moving from active organic to nitrate pool in soil profile on current day in HRU (kg N/ha)
- real ∗8 hmptl

  amount of phosphorus moving from active organic to nitrate pool in soil profile on current day in HRU (kg P/ha)
- real ∗8 rmn2tl

  amount of nitrogen moving from the fresh organic (residue) to the nitrate(80%) and active organic(20%) pools in soil profile on current day in HRU (kg N/ha)
- real ∗8 rwntl

  amount of nitrogen moving from active organic to stable organic pool in soil profile on current day in HRU (kg N/ha)
- real ∗8 gwseep

  amount of water recharging deep aquifer on current day in HRU (mm H2O)
- real ∗8 revapday

  amount of water moving from the shallow aquifer into the soil profile or being taken up by plant roots in the shallow aquifer or in the bank storage zone (mm H2O)
- real ∗8 rmp1tl

  amount of phosphorus moving from the labile mineral pool to the active mineral pool in the soil profile on the current day in the HRU (kg P/ha)
- real ∗8 rmptl

  amount of phosphorus moving from the fresh organic (residue) to the labile(80%) and organic(20%) pools in soil profile on current day in HRU (kg P/ha)
- real ∗8 roctl

  amount of phosphorus moving from the active mineral pool to the stable mineral pool in the soil profile on the current day in the HRU (kg P/ha)
- real ∗8 wdntl

  amount of nitrogen lost from nitrate pool by denitrification in soil profile on current day in HRU (kg N/ha)
- real ∗8 **cmn_bsn**
- real ∗8 **reswtr**
- real ∗8 wdlprch

  die-off factor for less persistent bacteria in streams (1/day)
- real ∗8 wdpres

  die-off factor for persistent bacteria in reservoirs (1/day)
- real ∗8 petmeas

  potential ET value read in for day (mm H2O)
- real ∗8 bury

loss of pesticide from active sediment layer by burial (mg pst)

- real ∗8 difus

  diffusion of pesticide from sediment to reach (mg pst)
- real ∗8 reactb

  amount of pesticide in sediment that is lost through reactions (mg pst)
- real ∗8 solpesto

  soluble pesticide concentration in outflow on day (mg pst/m^3)
- real ∗8 wdlpres

  die-off factor for less persistent bacteria in reservoirs (1/day)
- real ∗8 sorpesto

  sorbed pesticide concentration in outflow on day (mg pst/m^3)
- real ∗8 **spcon_bsn**
- real ∗8 **spexp_bsn**
- real ∗8 **solpesti**
- real ∗8 **sorpesti**
- real ∗8 msk_co1

  calibration coefficient to control impact of the storage time constant for the reach at bankfull depth (phi(10,:) upon the storage time constant for the reach used in the Muskingum flow method
- real ∗8 msk_co2

  calibration coefficient to control impact of the storage time constant for the reach at 0.1 bankfull depth (phi(13,:) upon the storage time constant for the reach used in the Muskingum flow method
- real ∗8 deepstp

  depth of water in deep aquifer in HRU (mm H2O)
- real ∗8 shallstp

  depth of water in shallow aquifer in HRU on previous day (mm H2O)
- real ∗8 snoprev

  amount of water stored as snow on previous day (mm H2O)
- real ∗8 swprev

  amount of water stored in soil profile in the HRU on the previous day (mm H2O)
- real ∗8 **ressolpo**
- real ∗8 **resorgno**
- real ∗8 **resorgpo**
- real ∗8 **resno3o**
- real ∗8 **reschlao**
- real ∗8 **resno2o**
- real ∗8 potevmm

  volume of water evaporated from pothole expressed as depth over HRU (mm H2O)
- real ∗8 potflwo

  volume of water released to main channel from pothole expressed as depth over HRU (mm H2O)
- real ∗8 potpcpmm

  precipitation falling on pothole water body expressed as depth over HRU (mm H2O)
- real ∗8 potsepmm

  seepage from pothole expressed as depth over HRU (mm H2O)
- real ∗8 qdbank

  streamflow contribution from bank storage (m^3 H2O)
- real ∗8 **resnh3o**
- real ∗8 bactminlp

  Threshold detection level for less persistent bacteria. When bacteria levels drop to this amount the model considers bacteria in the soil to be insignificant and sets the levels to zero (cfu/m^2)
- real ∗8 bactminp

  Threshold detection level for persistent bacteria. When bacteria levels drop to this amount the model considers bacteria in the soil to be insignificant and sets the levels to zero (cfu/m^2)

- real ∗8 trnsrch

  fraction of transmission losses from main channel that enter deep aquifer
- real ∗8 wp20p_plt

  overall rate change for persistent bacteria on foliage (1/day)
- real ∗8 potsedo

  sediment leaving pothole to main channel from HRU on day (metric tons/ha)
- real ∗8 **pest_sol**
- real ∗8 bact_swf

  fraction of manure containing active colony forming units (cfu)
- real ∗8 bactmx

  bacteria percolation coefficient. Ratio of solution bacteria in surface layer to solution bacteria in percolate
- real ∗8 cncoef

  plant ET curve number coefficient
- real ∗8 wp20lp_plt

  overall rate change for less persistent bacteria on foliage (1/day)
- real ∗8 **cdn_bsn**
- real ∗8 **sdnco_bsn**
- real ∗8 **bactmin**
- real ∗8 cn_froz

  drainge coefficient (mm day -1)
- real ∗8 dorm_hr

  time threshold used to define dormant (hours)
- real ∗8 smxco

  adjustment factor for max curve number s factor (0-1)
- real ∗8 tb_adj

  adjustment factor for subdaily unit hydrograph basetime
- real ∗8 chla_subco

  regional adjustment on sub chla_a loading (fraction)
- real ∗8 depimp_bsn

  depth to impervious layer. Used to model perched water tables in all HRUs in watershed (mm)
- real ∗8 ddrain_bsn

  depth to the sub-surface drain (mm)
- real ∗8 tdrain_bsn

  time to drain soil to field capacity (hours)
- real ∗8 **gdrain_bsn**
- real ∗8 **rch_san**
- real ∗8 **rch_sil**
- real ∗8 **rch_cla**
- real ∗8 **rch_sag**
- real ∗8 **rch_lag**
- real ∗8 **rch_gra**
- real ∗8 hlife_ngw_bsn

  Half-life of nitrogen in groundwater? (days)
- real ∗8 **ch_opco_bsn**
- real ∗8 **ch_onco_bsn**
- real ∗8 decr_min

  Minimum daily residue decay.
- real ∗8 rcn_sub_bsn

  Concentration of nitrogen in the rainfall (mg/kg)
- real ∗8 **bc1_bsn**
- real ∗8 **bc2_bsn**
- real ∗8 **bc3_bsn**

- real ∗8 **bc4_bsn**
- real ∗8 **anion_excl_bsn**
- real ∗8, dimension(:), allocatable wat_tbl

  water table based on depth from soil surface (mm)
- real ∗8, dimension(:), allocatable **sol_swpwt**
- real ∗8, dimension(:,:), allocatable **vwt**
- real ∗8 re_bsn

  Effective radius of drains (range 3.0 - 40.0) (mm)
- real ∗8 sdrain_bsn

  Distance bewtween two drain or tile tubes (range 7600.0 - 30000.0) (mm)
- real ∗8 **sstmaxd_bsn**
- real ∗8 drain_co_bsn

  Drainage coeffcient (range 10.0 - 51.0) (mm-day-1)
- real ∗8 latksatf_bsn

  Multiplication factor to determine lateral ksat from SWAT ksat input value for HRU (range 0.01 - 4.0)
- real ∗8 pc_bsn

  Pump capacity (def val = 1.042 mm h-1 or 25 mm day-1) (mm h-1)
- integer idlast

  number of days simulated in month (none)
- integer **i_subhw**
- integer **imgt**
- integer **iwtr**
- integer **ifrttyp**
- integer **mo_atmo**
- integer **mo_atmo1**
- integer **ifirstatmo**
- integer **iyr_atmo**
- integer **iyr_atmo1**
- integer **matmo**
- integer mch

  maximum number of channels
- integer mcr

  maximum number of crops grown per year
- integer mcrdb

  maximum number of crops/landcover in database file (crop.dat)
- integer mfcst

  maximum number of forecast stations
- integer mfdb

  maximum number of fertilizers in fert.dat
- integer mhru

  maximum number of HRUs in watershed
- integer mhyd

  maximum number of hydrograph nodes
- integer mpdb

  maximum number of pesticides in pest.dat
- integer mrg

  maximum number of rainfall/temp gages (none)
- integer mcut

  maximum number of cuttings per year
- integer mgr

  maximum number of grazings per year
- integer mnr

maximum number of years of rotation

- integer myr

  maximum number of years of simulation

- integer isubwq

  subbasin water quality code
  0 do not calculate algae/CBOD 1 calculate algae/CBOD drainmod tile equations

- integer **ffcst**
- integer isproj

  special project code (none):
  1 test rewind (run simulation twice)

- integer nbyr

  number of calendar years simulated (none)

- integer irte

  water routing method (none):
  0 variable storage method
  1 Muskingum method

- integer nrch

  number of reaches in watershed (none)

- integer nres

  total number of reservoirs in watershed (none)

- integer nhru

  number of last HRU in previous subbasin or
  number of HRUs in watershed (none)

- integer i_mo

  current month being simulated or month of next day of simulation (none)

- integer immo

  current cumulative month of simulation (none)

- integer **mo**
- integer wndsim

  wind speed input code (noen)
  1 measured data read for each subbasin
  2 data simulated for each subbasin

- integer icode

  variable to hold value for icodes(:) (none)

- integer ihout

  variable to hold value for ihouts(:) (none)

- integer inum1

  variable to hold value for inum1s(:) (subbasin number) (none)

- integer inum2

  variable to hold value for inum2s(:) (none)

- integer inum3

  variable to hold value for inum3s(:) (none)

- integer inum4

  variable to hold value for inum4s(:) (none)

- integer icfac

  icfac = 0 for C-factor calculation using Cmin (as described in manual)
  = 1 for new C-factor calculation from RUSLE (no minimum needed)

- integer **inum5**
- integer **inum6**
- integer **inum7**
- integer **inum8**
- integer mrech

maximum number of rechour files

- integer nrgage

  number of raingage files (none)
- integer nrgfil

  number of rain gages per file (none)
- integer nrtot

  total number of rain gages (none)
- integer ntgage

  number of temperature gage files (none)
- integer ntgfil

  number of temperature gages per file (none)
- integer nttot

  total number of temperature gages (none)
- integer tmpsim

  temperature input code (none)
  1 measured data read for each subbasin
  2 data simulated for each subbasin
- integer icrk

  crack flow code
  1: simulate crack flow in watershed
- integer irtpest

  number of pesticide to be routed through the watershed. Redefined to the sequence number of pestcide in NPNO(:) which is to be routed through the watershed (none)
- integer igropt

  Qual2E option for calculating the local specific growth rate of algae
  1: multiplicative.
- integer lao

  Qual2E light averaging option. Qual2E defines four light averaging options. The only option currently available in SWAT is #2.
- integer npmx

  number of different pesticides used in the simulation (none)
- integer curyr

  current year in simulation (sequence) (none)
- integer itdrn

  tile drainage equations flag/code
  1 simulate tile flow using subroutine drains(wt_shall)
  0 simulate tile flow using subroutine origtile(wt_shall,d)
- integer iwtdn

  water table depth algorithms flag/code
  1 simulate wt_shall using subroutine new water table depth routine
  0 simulate wt_shall using subroutine original water table depth routine
- integer ismax

  maximum depressional storage selection flag/code (none)
  0 = static depressional storage (stmaxd) read from .bsn for the global value or .sdr for specific HRUs
  1 = dynamic storage (stmaxd) based on random roughness, tillage and cumulative rainfall intensity by depstor.f90
- integer iroutunit

  not being implemented in this version drainmod tile equations
- integer **ires_nut**
- integer iclb

  auto-calibration flag
- integer mrecc

  maximum number of reccnst files
- integer mrecd

maximum number of recday files

- integer mrecm

  maximum number of recmon files

- integer mtil

  max number of tillage types in till.dat

- integer mudb

  maximum number of urban land types in urban.dat

- integer idist

  rainfall distribution code
  0 for skewed normal dist
  1 for mixed exponential distribution

- integer mrecy

  maximum number of recyear files

- integer nyskip

  number of years to skip output summarization and printing (none)

- integer slrsim

  solar radiation input code (none)
  1 measured data read for each subbasin
  2 data simulated for each subbasin

- integer ideg

  channel degredation code
  0: do not compute channel degradation
  1: compute channel degredation (downcutting and widening)

- integer ievent

  rainfall/runoff code (none)
  0 daily rainfall/curve number technique 1 sub-daily rainfall/Green&Ampt/hourly routing 3 sub-daily rainfall/←
  Green&Ampt/hourly routing

- integer ipet

  code for potential ET method (none)
  0 Priestley-Taylor method
  1 Penman/Monteith method
  2 Hargreaves method
  3 read in daily potential ET data

- integer **iopera**
- integer idaf

  beginning day of simulation (julian date)

- integer idal

  ending day of simulation (julian date)

- integer rhsim

  relative humidity input code (none)
  1 measured data read for each subbasin
  2 data simulated for each subbasin

- integer leapyr

  leap year flag (none)
  0 leap year
  1 regular year

- integer id1

  first day of simulation in current year (julian date)

- integer mo_chk

  current month of simulation (none)

- integer nhtot

  total number of relative humidity records in file

- integer nstot

  total number of solar radiation records in file (none)

- integer nwtot

    total number of wind speed records in file
- integer ifirsts

    solar radiation data search code (none)
    0 first day of solar radiation data located in file
    1 first day of solar radiation data not located in file
- integer ifirsth

    relative humidity data search code (none)
    0 first day of relative humidity data located in file
    1 first day of relative humidity data not located in file
- integer ifirstw

    wind speed data search code (none)
    0 first day of wind speed data located in file
    1 first day of wind speed data not located in file
- integer **icst**
- integer ilog

    streamflow print code (none)
    0 print streamflow in reach
    1 print Log10 streamflow in reach
- integer itotr

    number of output variables printed (output.rch)
- integer iyr

    current year of simulation (year)
- integer iwq

    stream water quality code
    0 do not model stream water quality
    1 model stream water quality (QUAL2E & pesticide transformations)
- integer iskip

    flag for calculations performed only for the first year of simulation (none)
- integer ifirstpet

    potential ET data search code (none)
    0 first day of potential ET data located in file
    1 first day of potential ET data not located in file
- integer iprp

    print code for output.pst file
    0 do not print pesticide output
    1 print pesticide output
- integer itotb

    number of output variables printed (output.sub)
- integer itots

    number of output variables printed (output.hru)
- integer itoth

    number of HRUs printed (output.hru/output.wtr)
- integer pcpsim

    rainfall input code (none)
    1 measured data read for each subbasin
    2 data simulated for each subbasin
- integer **nd_30**
- integer **iops**
- integer **iphr**
- integer **isto**
- integer **isol**
- integer fcstcycles

    number of times forecast period is simulated (using different weather generator seeds each time)

- integer fcstday

  beginning date of forecast period (julian date)
- integer fcstyr

  beginning year of forecast period
- integer iscen

  scenarios counter
- integer subtot

  number of subbasins in watershed (none)
- integer **ogen**
- integer mapp

  maximum number of applications
- integer mlyr

  maximum number of soil layers
- integer mpst

  max number of pesticides used in wshed
- integer mres

  maximum number of reservoirs
- integer msub

  maximum number of subbasins
- integer igen

  random number generator seed code (none):
  0: use default numbers
  1: generate new numbers in every simulation
- integer iprint

  print code (none): 0=monthly, 1=daily, 2=annually
- integer iida

  day being simulated (current julian date) (julian date)
- integer icn

  CN method flag (for testing alternative method):
  0 use traditional SWAT method which bases CN on soil moisture
  1 use alternative method which bases CN on plant ET
  2 use tradtional SWAT method which bases CN on soil moisture but rention is adjusted for mildly-sloped tiled-drained watersheds.
- integer ised_det

  max half-hour rainfall fraction calc option:
  0 generate max half-hour rainfall fraction from triangular distribution
  1 use monthly mean max half-hour rainfall fraction
- integer **fcstcnt**
- integer **mtran**
- integer **idtill**
- integer, dimension(100) **ida_lup**
- integer, dimension(100) **iyr_lup**
- integer **no_lup**
- integer **no_up**
- integer **nostep**
- character(len=8) date

  date simulation is performed where leftmost eight characters are set to a value of yyyymmdd, where yyyy is the year, mm is the month and dd is the day
- character(len=10) time

  time simulation is performed where leftmost ten characters are set to a value of hhmmss.sss, where hh is the hour, mm is the minutes and ss.sss is the seconds and milliseconds
- character(len=5) zone

  time difference with respect to Coordinated Universal Time (ie Greenwich Mean Time)

- character(len=13) calfile

  name of file containing calibration parameters
- character(len=13) rhfile

  relative humidity file name (.hmd)
- character(len=13) slrfile

  solar radiation file name (.slr)
- character(len=13) wndfile

  wind speed file name (.wnd)
- character(len=13) petfile

  potential ET file name (.pet)
- character(len=13) **atmofile**
- character(len=13) **lucfile**
- character(len=13) septdb

  name of septic tank database file (septwq1.dat)
- character(len=13) **dpd_file**
- character(len=13) **wpd_file**
- character(len=13) **rib_file**
- character(len=13) **sfb_file**
- character(len=13) **lid_file**
- integer, dimension(9) idg

  array location of random number seed used for a given process
- integer, dimension(:), allocatable **ifirstr**
- integer, dimension(:), allocatable **ifirsthr**
- integer, dimension(8) values

  values(1): year simulation is performed
  values(2): month simulation is performed
  values(3): day in month simulation is performed
  values(4): time difference with respect to Coordinated Universal Time (ie Greenwich Mean Time)
  values(5): hour simulation is performed
  values(6): minute simulation is performed
  values(7): second simulation is performed
  values(8): millisecond simulation is performed
- integer, dimension(13) ndays

  julian date for last day of preceding month (where the array location is the number of the month). The dates are for leap years (julian date)
- integer **mapex**
- real ∗8, dimension(:), allocatable **flodaya**
- real ∗8, dimension(:), allocatable **seddaya**
- real ∗8, dimension(:), allocatable **orgndaya**
- real ∗8, dimension(:), allocatable **orgpdaya**
- real ∗8, dimension(:), allocatable **no3daya**
- real ∗8, dimension(:), allocatable **minpdaya**
- real ∗8, dimension(:), allocatable hi_targ

  harvest index target of cover defined at planting ((kg/ha)/(kg/ha))
- real ∗8, dimension(:), allocatable bio_targ

  biomass target (kg/ha)
- real ∗8, dimension(:), allocatable tnyld

  modifier for autofertilization target nitrogen content for plant (kg N/kg yield)
- integer, dimension(:), allocatable **idapa**
- integer, dimension(:), allocatable **iypa**
- integer, dimension(:), allocatable **ifirsta**
- integer, dimension(100) **mo_transb**
- integer, dimension(100) **mo_transe**
- integer, dimension(100) **ih_tran**

- integer msdb

  maximum number of sept wq data database (none)
- integer **iseptic**
- real ∗8, dimension(:), allocatable sptqs

  flow rate of the septic tank effluent per capita (m3/d)
- real ∗8, dimension(:), allocatable **percp**
- real ∗8, dimension(:), allocatable sptbodconcs

  Biological Oxygen Demand of the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable spttssconcs

  concentration of total suspended solid in the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable spttnconcs

  concentration of total nitrogen in the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable sptnh4concs

  concentration of total phosphorus of the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable sptno3concs

  concentration of nitrate in the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable sptno2concs

  concentration of nitrite in the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable sptorgnconcs

  concentration of organic nitrogen in the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable spttpconcs

  concentration of total phosphorus in the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable sptminps

  concentration of mineral phosphorus in the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable sptorgps

  concentration of organic phosphorus in the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable sptfcolis

  concentration of the facel caliform in the septic tank effluent (cfu/100ml)
- real ∗8, dimension(:), allocatable **failyr**
- real ∗8, dimension(:), allocatable **qstemm**
- real ∗8, dimension(:), allocatable bio_bod

  BOD concentration in biozone (kg/ha)
- real ∗8, dimension(:), allocatable biom

  biomass of live bacteria in biozone (kg/ha)
- real ∗8, dimension(:), allocatable rbiom

  daily change in biomass of live bacteria (kg/ha)
- real ∗8, dimension(:), allocatable **bio_amn**
- real ∗8, dimension(:), allocatable fcoli

  concentration of the fecal coliform in the biozone septic tank effluent (cfu/100ml)
- real ∗8, dimension(:), allocatable **bio_ntr**
- real ∗8, dimension(:), allocatable **bz_perc**
- real ∗8, dimension(:), allocatable sep_cap

  number of permanent residents in the hourse (none)
- real ∗8, dimension(:), allocatable plqm

  plaque in biozone (kg/ha)
- real ∗8, dimension(:), allocatable **bz_area**
- real ∗8, dimension(:), allocatable bz_z

  depth of biozone layer (mm)
- real ∗8, dimension(:), allocatable bz_thk

  thickness of biozone (mm)
- real ∗8, dimension(:), allocatable bio_bd

density of biomass (kg/m^ 3)

- real ∗8, dimension(:), allocatable cmup_kgh

  current soil carbon for first soil layer (kg/ha)
- real ∗8, dimension(:), allocatable cmtot_kgh

  current soil carbon integrated - aggregating (kg/ha)
- real ∗8, dimension(:), allocatable coeff_denitr

  denitrification rate coefficient (none)
- real ∗8, dimension(:), allocatable coeff_bod_dc

  BOD decay rate coefficient (m^ 3/day)
- real ∗8, dimension(:), allocatable coeff_bod_conv

  BOD to live bacteria biomass conversion factor (none)
- real ∗8, dimension(:), allocatable coeff_fc1

  field capacity calibration parameter 1 (none)
- real ∗8, dimension(:), allocatable coeff_fc2

  field capacity calibration parameter 2 (none)
- real ∗8, dimension(:), allocatable coeff_fecal

  fecal coliform bacteria decay rate coefficient (m^ 3/day)
- real ∗8, dimension(:), allocatable coeff_mrt

  mortality rate coefficient (none)
- real ∗8, dimension(:), allocatable coeff_nitr

  nitrification rate coefficient (none)
- real ∗8, dimension(:), allocatable coeff_plq

  conversion factor for plaque from TDS (none)
- real ∗8, dimension(:), allocatable coeff_rsp

  respiration rate coefficient (none)
- real ∗8, dimension(:), allocatable coeff_slg1

  slough-off calibration parameter (none)
- real ∗8, dimension(:), allocatable coeff_slg2

  slough-off calibration parameter (none)
- real ∗8, dimension(:), allocatable **coeff_pdistrb**
- real ∗8, dimension(:), allocatable **coeff_solpslp**
- real ∗8, dimension(:), allocatable **coeff_solpintc**
- real ∗8, dimension(:), allocatable **coeff_psorpmax**
- integer, dimension(:), allocatable isep_typ

  septic system type (none)
- integer, dimension(:), allocatable i_sep

  soil layer where biozone exists (none)
- integer, dimension(:), allocatable isep_opt

  septic system operation flag (1=active, 2=failing, 3 or 0=not operated) (none)
- integer, dimension(:), allocatable **sep_tsincefail**
- integer, dimension(:), allocatable **isep_tfail**
- integer, dimension(:), allocatable **isep_iyr**
- integer, dimension(:), allocatable **sep_strm_dist**
- integer, dimension(:), allocatable **sep_den**
- real ∗8, dimension(:), allocatable **sol_sumno3**
- real ∗8, dimension(:), allocatable **sol_sumsolp**
- real ∗8, dimension(:), allocatable **strsw_sum**
- real ∗8, dimension(:), allocatable **strstmp_sum**
- real ∗8, dimension(:), allocatable **strsn_sum**
- real ∗8, dimension(:), allocatable **strsp_sum**
- real ∗8, dimension(:), allocatable **strsa_sum**
- real ∗8, dimension(:), allocatable **spill_hru**

- real ∗8, dimension(:), allocatable **tile_out**
- real ∗8, dimension(:), allocatable **hru_in**
- real ∗8, dimension(:), allocatable **spill_precip**
- real ∗8, dimension(:), allocatable **pot_seep**
- real ∗8, dimension(:), allocatable **pot_evap**
- real ∗8, dimension(:), allocatable **pot_sedin**
- real ∗8, dimension(:), allocatable pot_solp

  soluble P loss rate in the pothole (.01 - 0.5) (1/d)
- real ∗8, dimension(:), allocatable **pot_solpi**
- real ∗8, dimension(:), allocatable pot_orgp

  amount of organic P in pothole water body (kg P)
- real ∗8, dimension(:), allocatable **pot_orgpi**
- real ∗8, dimension(:), allocatable pot_orgn

  amount of organic N in pothole water body (kg N)
- real ∗8, dimension(:), allocatable **pot_orgni**
- real ∗8, dimension(:), allocatable pot_mps

  amount of stable mineral pool P in pothole water body (kg N)
- real ∗8, dimension(:), allocatable **pot_mpsi**
- real ∗8, dimension(:), allocatable pot_mpa

  amount of active mineral pool P in pothole water body (kg N)
- real ∗8, dimension(:), allocatable **pot_mpai**
- real ∗8, dimension(:), allocatable **pot_no3i**
- real ∗8, dimension(:), allocatable **precip_in**
- real ∗8, dimension(:), allocatable **tile_sedo**
- real ∗8, dimension(:), allocatable **tile_no3o**
- real ∗8, dimension(:), allocatable **tile_solpo**
- real ∗8, dimension(:), allocatable **tile_orgno**
- real ∗8, dimension(:), allocatable **tile_orgpo**
- real ∗8, dimension(:), allocatable **tile_minpso**
- real ∗8, dimension(:), allocatable **tile_minpao**
- integer **ia_b**
- integer **ihumus**
- integer **itemp**
- integer **isnow**
- integer, dimension(46) ipdvar

  output variable codes for output.rch file (none)
- integer, dimension(mhruo) ipdvas

  output varaible codes for output.hru file (none)
- integer, dimension(msubo) ipdvab

  output variable codes for output.sub file (none)
- integer, dimension(:), allocatable ipdhru

  HRUs whose output information will be printed to the output.hru and output.wtr files.
- real ∗8, dimension(mstdo) wshddayo

  wshddayo(1) average amountof precipitation in watershed for the day (mm H20)
  wshddayo(3) surface runoff in watershed for day (mm H20)
  wshddayo(4) lateral flow contribution to streamflow in watershed for day (mm H20)
  wshddayo(5) water percolation past bottom of soil profile in watershed for day (mm H20)
  wshddayo(6) water yield to streamflow from HRUs in watershed for day (mm H20)
  wshddayo(7) actual evapotranspiration in watershed for day (mm H20)
  wshddayo(8) average maximum temperature in watershed for the day (deg C)
  wshddayo(9) average minimum temperature in watershed for the day (deg C)
  wshddayo(12) sediment yield from HRUs in watershed for day (metric tons or metric tons/ha)
  wshddayo(13) sediment loading to ponds in watershed for day (metric tons)
  wshddayo(14) sediment loading from ponds in watershed for day (metric tons)
  wshddayo(15) net change in sediment level in ponds in watershed for day (metric tons)

wshddayo(16) sediment loading to wetlands for day in watershed (metric tons)
wshddayo(17) sediment loading to main channels from wetlands for day in watershed (metric tons)
wshddayo(18) net change in sediment in wetlands for day in watershed (metric tons)
wshddayo(19) evaporation from ponds in watershed for day (m^3 H2O)
wshddayo(20) seepage from ponds in watershed for day (m^3 H2O)
wshddayo(21) precipitation on ponds in watershed for day (m^3 H2O)
wshddayo(22) volume of water entering ponds in watershed for day (m^3 H2O)
wshddayo(23) volume of water leaving ponds in watershed for day (m^3 H2O)
wshddayo(24) evaporation from wetlands for day in watershed (m^3 H2O)
wshddayo(25) seepage from wetlands for day in watershed (m^3 H2O)
wshddayo(26) precipitation on wetlands for day in watershed (m^3 H2O)
wshddayo(27) volume of water entering wetlands on day in watershed (m^3 H2O)
wshddayo(28) volume of water leaving wetlands on day in watershed (m^3 H2O)
wshddayo(33) net change in water volume of ponds in watershed for day (m^3 H2O)
wshddayo(35) amount of water stored in soil profile in watershed at end of day (mm H20)
wshddayo(36) snow melt in watershed for day (mm H20)
wshddayo(37) sublimation in watershed for day (mm H20)
wshddayo(38) average amount of tributary channel transmission losses in watershed on day (mm H20)
wshddayo(39) freezing rain/snow fall in watershed for day (mm H20)
wshddayo(40) organic N loading to stream in watershed for day (kg N/ha)
wshddayo(41) organic P loading to stream in watershed for day (kg P/ha)
wshddayo(42) nitrate loading to stream in surface runoff in watershed for day (kg N/ha)
wshddayo(43) soluble P loading to stream in watershed for day (kg P/ha)
wshddayo(44) plant uptake of N in watershed for day (kg N/ha)
wshddayo(45) nitrate loading to stream in lateral flow in watershed for day (kg N/ha)
wshddayo(46) nitrate percolation past bottom of soil profile in watershed for day (kg N/ha)
wshddayo(104) groundwater contribution to stream in watershed on day (mm H20)
wshddayo(105) amount of water moving from shallow aquifer to plants/soil profile in watershed on day (mm H2O)
wshddayo(106) deep aquifer recharge in watershed on day (mm H2O)
wshddayo(107) total amount of water entering both aquifers in watershed on day (mm H2O)
wshddayo(108) potential evapotranspiration in watershed on day (mm H20)
wshddayo(109) drainage tile flow contribution to stream in watershed on day (mm H20)
wshddayo(110) NO3 yield (gwq) (kg/ha)
wshddayo(111) NO3 yield (tile) (mm H2O)

- real ∗8, dimension(mstdo) wshdmono

  watershed monthly output array (see definitions for wshddayo array elements) (varies)
  wshdmono(1) average amount of precipitation in watershed for the month (mm H2O)
  wshdmono(3) surface runoff in watershed for month (mm H2O)
  wshdmono(4) lateral flow contribution to streamflow in watershed for month (mm H2O)
  wshdmono(5) water percolation past bottom of soil profile in watershed for month (mm H2O)
  wshdmono(6) water yield to streamflow from HRUs in watershed for month (mm H2O)
  wshdmono(7) actual evapotranspiration in watershed for month (mm H2O)
  wshdmono(8) average maximum temperature in watershed for the month (deg C)
  wshdmono(9) average minimum temperature in watershed for the month (deg C)
  wshdmono(12) sediment yield from HRUs in watershed for the month (metric tons)
  wshdmono(39) freezing rain/snow fall in watershed for the month (mm H2O)
  wshdmono(40) organic N loading to stream in watershed for the month (kg N/ha)
  wshdmono(41) organic P loading to stream in watershed for the month (kg P/ha)
  wshdmono(42) nitrate loading to stream in surface runoff in watershed for the month (kg N/ha)
  wshdmono(43) soluble P loading to stream in watershed for the month (kg P/ha)
  wshdmono(44) plant uptake of N in watershed for the month (kg N/ha)
  wshdmono(45) nitrate loading to stream in lateral flow in watershed for the month (kg N/ha)
  wshdmono(46) nitrate percolation past bottom of soil profile in watershed for the month (kg N/ha)
  wshdmono(104) groundwater contribution to stream in watershed for the month (mm H2O)
  wshdmono(108) potential evapotranspiration in watershed for the month (mm H2O)
  wshdmono(109) drainage tile flow contribution to stream in watershed for the month (mm H2O)

- real ∗8, dimension(mstdo) wshdyro

  watershed annual output array (varies)
  wshdyro(1) average amount of precipitation in watershed for the year (mm H2O)
  wshdyro(3) surface runoff in watershed for year (mm H2O)
  wshdyro(4) lateral flow contribution to streamflow in watershed for year (mm H2O)
  wshdyro(5) water percolation past bottom of soil profile in watershed for year (mm H2O)
  wshdyro(6) water yield to streamflow from HRUs in watershed for year (mm H2O)

wshdyro(7) actual evapotranspiration in watershed for year (mm H2O)
wshdyro(8) average maximum temperature in watershed for the year (deg C)
wshdyro(9) average minimum temperature in watershed for the year (deg C)
wshdyro(12) sediment yield from HRUs in watershed for the year (metric tons)
wshdyro(40) organic N loading to stream in watershed for the year (kg N/ha)
wshdyro(41) organic P loading to stream in watershed for the year (kg P/ha)
wshdyro(42) nitrate loading to stream in surface runoff in watershed for the year (kg N/ha)
wshdyro(43) soluble P loading to stream in watershed for the year (kg P/ha)
wshdyro(44) plant uptake of N in watershed for the year
wshdyro(45) nitrate loading to stream in lateral flow in watershed for the year (kg N/ha)
wshdyro(46) nitrate percolation past bottom of soil profile in watershed for the year (kg N/ha)
wshdyro(104) groundwater contribution to stream in watershed for the year (mm H2O)
wshdyro(108) potential evapotranspiration in watershed for the year (mm H2O)
wshdyro(109) drainage tile flow contribution to stream in watershed for the year (mm H2O)

- real ∗8, dimension(16) **fcstaao**
- real ∗8, dimension(mstdo) wshdaao

  watershed average annual output array (varies)
  wshdaao(1) precipitation in watershed (mm H2O)
  wshdaao(3) surface runoff loading to main channel in watershed (mm H2O)
  wshdaao(4) lateral flow loading to main channel in watershed (mm H2O)
  wshdaao(5) percolation of water out of root zone in watershed (mm H2O)
  wshdaao(7) actual evapotranspiration in watershed (mm H2O)
  wshdaao(13) sediment loading to ponds in watershed (metric tons)
  wshdaao(14) sediment loading from ponds in watershed (metric tons)
  wshdaao(15) net change in sediment level in ponds in watershed (metric tons)
  wshdaao(19) evaporation from ponds in watershed (m^3 H2O)
  wshdaao(20) seepage from ponds in watershed (m^3 H2O)
  wshdaao(21) precipitation on ponds in watershed (m^3 H2O)
  wshdaao(22) volume of water entering ponds in watershed (m^3 H2O)
  wshdaao(23) volume of water leaving ponds in watershed (m^3 H2O)
  wshdaao(38) transmission losses in watershed (mm H2O)

- real ∗8, dimension(:,:), allocatable wpstdayo

  wpstdayo(1,:) amount of pesticide type in surface runoff contribution to stream in watershed on day (in solution) (mg pst/ha)
  wpstdayo(2,:) amount of pesticide type in surface runoff contribution to stream in watershed on day (sorbed to sediment) (mg pst/ha)
  wpstdayo(3,:) amount of pesticide type leached from soil profile in watershed on day (kg pst/ha)
  wpstdayo(4,:) amount of pesticide type in lateral flow contribution to stream in watershed on day (kg pst/ha)

- real ∗8, dimension(:,:), allocatable **wpstmono**
- real ∗8, dimension(:,:), allocatable **wpstyro**
- real ∗8, dimension(:,:), allocatable bio_hv

  harvested biomass (dry weight) (kg/ha)

- real ∗8, dimension(:,:), allocatable yldkg

  yield (dry weight) by crop type in the HRU (kg/ha)

- real ∗8, dimension(:,:), allocatable rchmono

  reach monthly output array (varies)
  rchmono(1,:) flow into reach during month (m^3/s)
  rchmono(2,:) flow out of reach during month (m^3/s)
  rchmono(3,:) sediment transported into reach during month (metric tons)
  rchmono(4,:) sediment transported out of reach during month (metric tons)
  rchmono(5,:) sediment concentration in outflow during month (mg/L)
  rchmono(6,:) organic N transported into reach during month (kg N)
  rchmono(7,:) organic N transported out of reach during month (kg N)
  rchmono(8,:) organic P transported into reach during month (kg P)
  rchmono(9,:) organic P transported out of reach during month (kg P)
  rchmono(10,:) evaporation from reach during month (m^3/s)
  rchmono(11,:) transmission losses from reach during month (m^3/s)
  rchmono(12,:) conservative metal #1 transported out of reach during month (kg)
  rchmono(13,:) conservative metal #2 transported out of reach during month (kg)
  rchmono(14,:) conservative metal #3 transported out of reach during month (kg)
  rchmono(15,:) nitrate transported into reach during month (kg N)

rchmono(16,:) nitrate transported out of reach during month (kg N)
rchmono(17,:) soluble P transported into reach during month (kg P)
rchmono(18,:) soluble P transported out of reach during month (kg P)
rchmono(19,:) soluble pesticide transported into reach during month (mg pst)
rchmono(20,:) soluble pesticide transported out of reach during month (mg pst)
rchmono(21,:) sorbed pesticide transported into reach during month (mg pst)
rchmono(22,:) sorbed pesticide transported out of reach during month (mg pst)
rchmono(23,:) amount of pesticide lost through reactions in reach during month (mg pst)
rchmono(24,:) amount of pesticide lost through volatilization from reach during month (mg pst)
rchmono(25,:) amount of pesticide settling out of reach to bed sediment during month (mg pst)
rchmono(26,:) amount of pesticide resuspended from bed sediment to reach during month (mg pst)
rchmono(27,:) amount of pesticide diffusing from reach to bed sediment during month (mg pst)
rchmono(28,:) amount of pesticide in sediment layer lost through reactions during month (mg pst)
rchmono(29,:) amount of pesticide in sediment layer lost through burial during month (mg pst)
rchmono(30,:) chlorophyll-a transported into reach during month (kg chla)
rchmono(31,:) chlorophyll-a transported out of reach during month (kg chla)
rchmono(32,:) ammonia transported into reach during month (kg N)
rchmono(33,:) ammonia transported out of reach during month (kg N)
rchmono(34,:) nitrite transported into reach during month (kg N)
rchmono(35,:) nitrite transported out of reach during month (kg N)
rchmono(36,:) CBOD transported into reach during month (kg O2)
rchmono(37,:) CBOD transported out of reach during month (kg O2)
rchmono(38,:) dissolved oxygen transported into reach during month (kg O2)
rchmono(39,:) dissolved oxygen transported out of reach during month (kg O2)
rchmono(40,:) persistent bacteria transported out of reach during month (kg bact)
rchmono(41,:) less persistent bacteria transported out of reach during month (kg bact)
rchmono(43,:) total N (org N + no3 + no2 + nh4 outs) (kg)
rchmono(44,:) total P (org P + sol p outs) (kg)

- real ∗8, dimension(:,:), allocatable rchyro

  reach annual output array (varies)
  rchyro(1,:) flow into reach during year (m^3/s)
  rchyro(2,:) flow out of reach during year (m^3/s)
  rchyro(3,:) sediment transported into reach during year (metric tons)
  rchyro(4,:) sediment transported out of reach during year (metric tons)
  rchyro(5,:) sediment concentration in outflow during year (mg/L)
  rchyro(6,:) organic N transported into reach during year (kg N)
  rchyro(7,:) organic N transported out of reach during year (kg N)
  rchyro(8,:) organic P transported into reach during year (kg P)
  rchyro(9,:) organic P transported out of reach during year (kg P)
  rchyro(10,:) evaporation from reach during year (m^3/s)
  rchyro(11,:) transmission losses from reach during year (m^3/s)
  rchyro(12,:) conservative metal #1 transported out of reach during year (kg)
  rchyro(13,:) conservative metal #2 transported out of reach during year (kg)
  rchyro(14,:) conservative metal #3 transported out of reach during year (kg)
  rchyro(15,:) nitrate transported into reach during year (kg N)
  rchyro(16,:) nitrate transported out of reach during year (kg N)
  rchyro(17,:) soluble P transported into reach during year (kg P)
  rchyro(18,:) soluble P transported out of reach during year (kg P)
  rchyro(19,:) soluble pesticide transported into reach during year (mg pst)
  rchyro(20,:) soluble pesticide transported out of reach during year (mg pst)
  rchyro(21,:) sorbed pesticide transported into reach during year (mg pst)
  rchyro(22,:) sorbed pesticide transported out of reach during year (mg pst)
  rchyro(23,:) amount of pesticide lost through reactions in reach during year!> (mg pst)
  rchyro(24,:) amount of pesticide lost through volatilization from reach during year (mg pst)
  rchyro(25,:) amount of pesticide settling out of reach to bed sediment during year (mg pst)
  rchyro(26,:) amount of pesticide resuspended from bed sediment to reach during year (mg pst)
  rchyro(27,:) amount of pesticide diffusing from reach to bed sediment during year (mg pst)
  rchyro(28,:) amount of pesticide in sediment layer lost through reactions during year (mg pst)
  rchyro(29,:) amount of pesticide in sediment layer lost through burial during year (mg pst)
  rchyro(30,:) chlorophyll-a transported into reach during year (kg chla)
  rchyro(31,:) chlorophyll-a transported out of reach during year (kg chla)
  rchyro(32,:) ammonia transported into reach during year (kg N)
  rchyro(33,:) ammonia transported out of reach during year (kg N)

rchyro(34,:) nitrite transported into reach during year (kg N)
rchyro(35,:) nitrite transported out of reach during year (kg N)
rchyro(36,:) CBOD transported into reach during year (kg O2)
rchyro(37,:) CBOD transported out of reach during year (kg O2)
rchyro(38,:) dissolved oxygen transported into reach during year (kg O2)
rchyro(39,:) dissolved oxygen transported out of reach during year (kg O2)
rchyro(40,:) persistent bacteria transported out of reach during year (kg bact)
rchyro(41,:) less persistent bacteria transported out of reach during year (kg bact)

- real ∗8, dimension(:,:), allocatable **wpstaao**
- real ∗8, dimension(:,:), allocatable hrumono

HRU monthly output data array (varies)
hrumono(1,:) precipitation in HRU during month (mm H2O)
hrumono(2,:) amount of precipitation falling as freezing rain/snow in HRU during month (mm H2O)
hrumono(3,:) amount of snow melt in HRU during month (mm H2O)
hrumono(4,:) amount of surface runoff to main channel from HRU during month (ignores impact of transmission losses) (mm H2O)
hrumono(5,:) amount of lateral flow contribution to main channel from HRU during month (mm H2O)
hrumono(6,:) amount of groundwater flow contribution to main channel from HRU during month (mm H2O)
hrumono(7,:) amount of water moving from shallow aquifer to plants or soil profile in HRU during mont (mm H2O)h
hrumono(8,:) amount of water recharging deep aquifer in HRU during month (mm H2O)
hrumono(9,:) total amount of water entering both aquifers from HRU during month (mm H2O)
hrumono(10,:) water yield (total amount of water entering main channel) from HRU during month (mm H2O)
hrumono(11,:) amount of water percolating out of the soil profile and into the vadose zone in HRU during month (mm H2O)
hrumono(12,:) actual evapotranspiration in HRU during month (mm H2O)
hrumono(13,:) amount of transmission losses from tributary channels in HRU for month (mm H2O)
hrumono(14,:) sediment yield from HRU for month (metric tons/ha)
hrumono(15,:) actual amount of transpiration that occurs during month in HRU (mm H2O)
hrumono(16,:) actual amount of evaporation (from soil) that occurs during month in HRU (mm H2O)
hrumono(17,:) amount of nitrogen applied in continuous fertilizer operation during month in HRU (kg N/ha)
hrumono(18,:) amount of phosphorus applied in continuous fertilizer operation during month in HRU (kg P/ha)
hrumono(19,:) amount of surface runoff generated during month in HRU (mm H2O)
hrumono(20,:) CN values during month in HRU (none)
hrumono(21,:) sum of daily soil water values used to calculate the curve number (mm H2O)
hrumono(22,:) amount of irrigation water applied to HRU during month (mm H2O)
hrumono(23,:) amount of water removed from shallow aquifer in HRU for irrigation during month (mm H2O)
hrumono(24,:) amount of water removed from deep aquifer in HRU for irrigation during month (mm H2O)
hrumono(25,:) potential evapotranspiration in HRU during month (mm H2O)
hrumono(26,:) monthly amount of N (organic & mineral) applied in HRU during grazing (kg N/ha)
hrumono(27,:) monthly amount of P (organic & mineral) applied in HRU during grazing (kg P/ha)
hrumono(28,:) monthly amount of N (organic & mineral) auto-applied in HRU (kg N/ha)
hrumono(29,:) monthly amount of P (organic & mineral) auto-applied in HRU (kg P/ha)
hrumono(30,:) sum of daily soil temperature values (deg C) hrumono(31,:) water stress days in HRU during month (stress days)
hrumono(32,:) temperature stress days in HRU during month (stress days)
hrumono(33,:) nitrogen stress days in HRU during month (stress days)
hrumono(34,:) phosphorus stress days in HRU during month (stress days)
hrumono(35,:) organic nitrogen in surface runoff in HRU during month (kg N/ha)
hrumono(36,:) organic phosphorus in surface runoff in HRU during month (kg P/ha)
hrumono(37,:) nitrate in surface runoff in HRU during month (kg N/ha)
hrumono(38,:) nitrate in lateral flow in HRU during month (kg N/ha)
hrumono(39,:) soluble phosphorus in surface runoff in HRU during month (kg P/ha)
hrumono(40,:) amount of nitrogen removed from soil by plant uptake in HRU during month (kg N/ha)
hrumono(41,:) nitrate percolating past bottom of soil profile in HRU during month (kg N/ha)
hrumono(42,:) amount of phosphorus removed from soil by plant uptake in HRU during month (kg P/ha)
hrumono(43,:) amount of phosphorus moving from labile mineral to active mineral pool in HRU during month (kg P/ha)
hrumono(44,:) amount of phosphorus moving from active mineral to stable mineral pool in HRU during month (kg P/ha)
hrumono(45,:) amount of nitrogen applied to HRU in fertilizer and grazing operations during month (kg N/ha)
hrumono(46,:) amount of phosphorus applied to HRU in fertilizer and grazing operations during month (kg P/ha)
hrumono(47,:) amount of nitrogen added to soil by fixation in HRU during month (kg N/ha)
hrumono(48,:) amount of nitrogen lost by denitrification in HRU during month (kg N/ha)

hrumono(49,:) amount of nitrogen moving from active organic to nitrate pool in HRU during month (kg N/ha)
hrumono(50,:) amount of nitrogen moving from active organic to stable organic pool in HRU during month (kg N/ha)
hrumono(51,:) amount of phosphorus moving from organic to labile mineral pool in HRU during month (kg P/ha)
hrumono(52,:) amount of nitrogen moving from fresh organic to nitrate and active organic pools in HRU during month (kg N/ha)
hrumono(53,:) amount of phosphorus moving from fresh organic to the labile mineral and organic pools in HRU during month (kg P/ha)
hrumono(54,:) amount of nitrogen added to soil in rain (kg N/ha)
hrumono(61,:) daily soil loss predicted with USLE equation (metric tons/ha)
hrumono(62,:) drainage tile flow contribution to main channel from HRU in month (mm H2O)
hrumono(63,:) less persistent bacteria transported to main channel from HRU during month (bacteria/ha)
hrumono(64,:) persistent bacteria transported to main channel from HRU during month (bacteria/ha)
hrumono(65,:) nitrate loading from groundwater in HRU to main channel during month (kg N/ha)
hrumono(66,:) soluble P loading from groundwater in HRU to main channel during month (kg P/ha)
hrumono(67,:) loading of mineral P attached to sediment in HRU to main channel during month (kg P/ha)

- real ∗8, dimension(:,:), allocatable rchdy

  rchdy(1,:) flow into reach on day (m^3/s)
  rchdy(2,:) flow out of reach on day (m^3/s)
  rchdy(3,:) evaporation from reach on day (m^3/s)
  rchdy(4,:) transmission losses from reach on day (m^3/s)
  rchdy(5,:) sediment transported into reach on day (metric tons)
  rchdy(6,:) sediment transported out of reach on day (metric tons)
  rchdy(7,:) sediment concentration in outflow (mg/L)
  rchdy(8,:) organic N transported into reach on day (kg N)
  rchdy(9,:) organic N transported out of reach on day (kg N)
  rchdy(10,:) organic P transported into reach on day (kg P)
  rchdy(11,:) organic P transported out of reach on day (kg P)
  rchdy(12,:) nitrate transported into reach on day (kg N)
  rchdy(13,:) nitrate transported out of reach on day (kg N)
  rchdy(14,:) ammonia transported into reach on day (kg N)
  rchdy(15,:) ammonia transported out of reach on day (kg N)
  rchdy(16,:) nitrite transported into reach on day (kg N)
  rchdy(17,:) nitrite transported out of reach on day (kg N)
  rchdy(18,:) soluble P transported into reach on day (kg P)
  rchdy(19,:) soluble P transported out of reach on day (kg P)
  rchdy(20,:) chlorophyll-a transported into reach on day (kg chla)
  rchdy(21,:) chlorophyll-a transported out of reach on day (kg chla)
  rchdy(22,:) CBOD transported into reach on day (kg O2)
  rchdy(23,:) CBOD transported out of reach on day (kg O2)
  rchdy(24,:) dissolved oxygen transported into reach on day (kg O2)
  rchdy(25,:) dissolved oxygen transported out of reach on day (kg O2)
  rchdy(26,:) soluble pesticide transported into reach on day (mg pst)
  rchdy(27,:) soluble pesticide transported out of reach o day (mg pst)
  rchdy(28,:) sorbed pesticide transported into reach on day (mg pst)
  rchdy(29,:) sorbed pesticide transported out of reach on day (mg pst)
  rchdy(30,:) amount of pesticide lost through reactions in reach on day (mg pst)
  rchdy(31,:) amount of pesticide lost through volatilization from reach on day (mg pst)
  rchdy(32,:) amount of pesticide settling out of reach to bed sediment on day (mg pst)
  rchdy(33,:) amount of pesticide resuspended from bed sediment to reach on day (mg pst)
  rchdy(34,:) amount of pesticide diffusing from reach to bed sediment on day (mg pst)
  rchdy(35,:) amount of pesticide in sediment layer lost through reactions on day (mg pst)
  rchdy(36,:) amount of pesticide in sediment layer lost through burial on day (mg pst)
  rchdy(37,:) amount of pesticide stored in river bed sediments (mg pst)
  rchdy(38,:) persistent bacteria transported out of reach on day (kg bact)
  rchdy(39,:) less persistent bacteria transported out of reach on day (kg bact)
  rchdy(40,:) amount of conservative metal #1 transported out of reach on day (kg)
  rchdy(41,:) amount of conservative metal #2 transported out of reach on day (kg)
  rchdy(42,:) amount of conservative metal #3 transported out of reach on day (kg)
  rchdy(43,:) total N (org N + no3 + no2 + nh4 outs) (kg)
  rchdy(44,:) total P (org P + sol p outs) (kg)

- real ∗8, dimension(:,:), allocatable hruyro

  HRU annual output array (varies) hruyro(1,:) precipitation in HRU during year (mm H2O)
  hruyro(2,:) amount of precipitation falling as freezing rain/snow in HRU during year (mm H2O)

hruyro(3,:) amount of snow melt in HRU during year (mm H2O)
hruyro(4,:) amount of surface runoff to main channel from HRU during year (ignores impact of transmission losses) (mm H2O)
hruyro(5,:) amount of lateral flow contribution to main channel from HRU during year (mm H2O)
hruyro(6,:) amount of groundwater flow contribution to main channel from HRU during year (mm H2O)
hruyro(7,:) amount of water moving from shallow aquifer to plants or soil profile in HRU during year (mm H2O)
hruyro(8,:) amount of water recharging deep aquifer in HRU during year (mm H2O)
hruyro(9,:) total amount of water entering both aquifers from HRU during year (mm H2O)
hruyro(10,:) water yield (total amount of water entering main channel) from HRU during year (mm H2O)
hruyro(11,:) amount of water percolating out of the soil profile and into the vadose zone in HRU during year (mm H2O)
hruyro(12,:) actual evapotranspiration in HRU during year (mm H2O)
hruyro(13,:) amount of transmission losses from tributary channels in HRU for year (mm H2O)
hruyro(14,:) sediment yield from HRU for year (metric tons/ha)
hruyro(15,:) actual amount of transpiration that occurs during year in HRU (mm H2O)
hruyro(16,:) actual amount of evaporation (from soil) that occurs during year in HRU (mm H2O)
hruyro(17,:) amount of nitrogen applied in continuous fertilizer operation during year in HRU (kg N/ha)
hruyro(18,:) amount of phosphorus applied in continuous fertilizer operation during year in HRU (kg P/ha)
hruyro(23,:) amount of water removed from shallow aquifer in HRU for irrigation during year (mm H2O)
hruyro(24,:) amount of water removed from deep aquifer in HRU for irrigation during year (mm H2O)
hruyro(25,:) potential evapotranspiration in HRU during year (mm H2O)
hruyro(26,:) annual amount of N (organic & mineral) applied in HRU during grazing (kg N/ha)
hruyro(27,:) annual amount of P (organic & mineral) applied in HRU during grazing (kg P/ha)
hruyro(28,:) annual amount of N (organic & mineral) auto-applied in HRU (kg N/ha)
hruyro(29,:) annual amount of P (organic & mineral) auto-applied in HRU (kg P/ha)
hruyro(31,:) water stress days in HRU during year (stress days)
hruyro(32,:) temperature stress days in HRU during year (stress days)
hruyro(33,:) nitrogen stress days in HRU during year (stress days)
hruyro(34,:) phosphorus stress days in HRU during year (stress days)
hruyro(35,:) organic nitrogen in surface runoff in HRU during year (kg N/ha)
hruyro(36,:) organic phosphorus in surface runoff in HRU during year (kg P/ha)
hruyro(37,:) nitrate in surface runoff in HRU during year (kg N/ha)
hruyro(38,:) nitrate in lateral flow in HRU during year (kg N/ha)
hruyro(39,:) soluble phosphorus in surface runoff in HRU during year (kg P/ha)
hruyro(40,:) amount of nitrogen removed from soil by plant uptake in HRU during year (kg N/ha)
hruyro(41,:) nitrate percolating past bottom of soil profile in HRU during year (kg N/ha)
hruyro(42,:) amount of phosphorus removed from soil by plant uptake in HRU during year (kg P/ha)
hruyro(43,:) amount of phosphorus moving from labile mineral to active mineral pool in HRU during year (kg P/ha)
hruyro(44,:) amount of phosphorus moving from active mineral to stable mineral pool in HRU during year (kg P/ha)
hruyro(45,:) amount of nitrogen applied to HRU in fertilizer and grazing operations during year (kg N/ha)
hruyro(46,:) amount of phosphorus applied to HRU in fertilizer and grazing operations during year (kg P/ha)
hruyro(47,:) amount of nitrogen added to soil by fixation in HRU during year (kg N/ha)
hruyro(48,:) amount of nitrogen lost by denitrification in HRU during year (kg N/ha)
hruyro(49,:) amount of nitrogen moving from active organic to nitrate pool in HRU during year (kg N/ha)
hruyro(50,:) amount of nitrogen moving from active organic to stable organic pool in HRU during year (kg N/ha)
hruyro(51,:) amount of phosphorus moving from organic to labile mineral pool in HRU during year (kg P/ha)
hruyro(52,:) amount of nitrogen moving from fresh organic to nitrate and active organic pools in HRU during year (kg N/ha)
hruyro(53,:) amount of phosphorus moving from fresh organic to the labile mineral and organic pools in HRU during year (kg P/ha)
hruyro(54,:) amount of nitrogen added to soil in rain during year (kg N/ha)
hruyro(61,:) daily soil loss predicted with USLE equation (metric tons/ha)
hruyro(63,:) less persistent bacteria transported to main channel from HRU during year (# bacteria/ha)
hruyro(64,:) persistent bacteria transported to main channel from HRU during year (# bacteria/ha)
hruyro(65,:) nitrate loading from groundwater in HRU to main channel during year (kg N/ha)
hruyro(66,:) soluble P loading from groundwater in HRU to main channel during year (kg P/ha)
hruyro(67,:) loading of mineral P attached to sediment in HRU to main channel during year (kg P/ha)

- real ∗8, dimension(:,:), allocatable rchaao

  reach average annual output array (varies)
  rchaao(1,:) flow into reach during simulation (m^3/s)
  rchaao(2,:) flow out of reach during simulation (m^3/s)
  rchaao(3,:) sediment transported into reach during simulation (metric tons)
  rchaao(4,:) sediment transported out of reach during simulation (metric tons)

rchaao(5,:) sediment concentration in outflow during simulation (mg/L)
rchaao(6,:) organic N transported into reach during simulation (kg N)
rchaao(7,:) organic N transported out of reach during simulation (kg N)
rchaao(8,:) organic P transported into reach during simulation (kg P)
rchaao(9,:) organic P transported out of reach during simulation (kg P)
rchaao(10,:) evaporation from reach during simulation (m^3/s)
rchaao(11,:) transmission losses from reach during simulation (m^3/s)
rchaao(12,:) conservative metal #1 transported out of reach during simulation (kg)
rchaao(13,:) conservative metal #2 transported out of reach during simulation (kg)
rchaao(14,:) conservative metal #3 transported out of reach during simulation (kg)
rchaao(15,:) nitrate transported into reach during simulation (kg N)
rchaao(16,:) nitrate transported out of reach during simulation (kg N)
rchaao(17,:) soluble P transported into reach during simulation (kg P)
rchaao(18,:) soluble P transported out of reach during simulation (kg P)
rchaao(19,:) soluble pesticide transported into reach during simulation
rchaao(20,:) soluble pesticide transported out of reach during simulation
rchaao(21,:) sorbed pesticide transported into reach during simulation
rchaao(22,:) sorbed pesticide transported out of reach during simulation
rchaao(23,:) amount of pesticide lost through reactions in reach during simulation
rchaao(24,:) amount of pesticide lost through volatilization from reach during simulation
rchaao(25,:) amount of pesticide settling out of reach to bed sediment during simulation
rchaao(26,:) amount of pesticide resuspended from bed sediment to reach during simulation
rchaao(27,:) amount of pesticide diffusing from reach to bed sediment during simulation
rchaao(28,:) amount of pesticide in sediment layer lost through reactions during simulation
rchaao(29,:) amount of pesticide in sediment layer lost through burial during simulation
rchaao(30,:) chlorophyll-a transported into reach during simulation (kg chla)
rchaao(31,:) chlorophyll-a transported out of reach during simulation (kg chla)
rchaao(32,:) ammonia transported into reach during simuation (kg N)
rchaao(33,:) ammonia transported out of reach during simuation (kg N)
rchaao(34,:) nitrite transported into reach during simuation (kg N)
rchaao(35,:) nitrite transported out of reach during simuation (kg N)
rchaao(36,:) CBOD transported into reach during simulation (kg O2)
rchaao(37,:) CBOD transported out of reach during simuation (kg O2)
rchaao(38,:) dissolved oxygen transported into reach during simuation (kg O2)
rchaao(39,:) dissolved oxygen transported out of reach during simulation (kg O2)
rchaao(40,:) persistent bacteria transported out of reach during simulation (kg bact)
rchaao(41,:) less persistent bacteria transported out of reach during simulation (kg bact)
rchaao(43,:) Total N (org N + no3 + no2 + nh4 outs) (kg)
rchaao(44,:) Total P (org P + sol p outs) (kg)

- real ∗8, dimension(:,:), allocatable submono

  subbasin monthly output array (varies)
  submono(1,:) precipitation in subbasin for month (mm H20)
  submono(2,:) snow melt in subbasin for month (mm H20)
  submono(3,:) surface runoff loading in subbasin for month (mm H20)
  submono(4,:) water yield from subbasin for month (mm H20)
  submono(5,:) potential evapotranspiration in subbasin for month (mm H20)
  submono(6,:) actual evapotranspiration in subbasin for month (mm H20)
  submono(7,:) sediment yield from subbasin for month (metric tons/ha)
  submono(8,:) organic N loading from subbasin for month (kg N/ha)
  submono(9,:) organic P loading from subbasin for month (kg P/ha)
  submono(10,:) NO3 loading from surface runoff in subbasin for month (kg N/ha)
  submono(11,:) soluble P loading from subbasin for month (kg P/ha)
  submono(12,:) groundwater loading from subbasin for month (mm H20)
  submono(13,:) percolation out of soil profile in subbasin for month (mm H20)
  submono(14,:) loading to reach of mineral P attached to sediment from subbasin for month (kg P/ha)

- real ∗8, dimension(:,:), allocatable subyro

  subbasin annual output array (varies)
  subyro(1,:) precipitation in subbasin for year (mm H2O)
  subyro(2,:) snow melt in subbasin for year (mm H2O)
  subyro(3,:) surface runoff loading in subbasin for year (mm H2O)
  subyro(4,:) water yield from subbasin for year (mm H2O)
  subyro(5,:) potential evapotranspiration in subbasin for year (mm H2O)
  subyro(6,:) actual evapotranspiration in subbasin for year (mm H2O)

subyro(7,:) sediment yield from subbasin for year (metric tons/ha)
subyro(8,:) organic N loading from subbasin for year (kg N/ha)
subyro(9,:) organic P loading from subbasin for year (kg P/ha)
subyro(10,:) NO3 loading from surface runoff in subbasin for year (kg N/ha)
subyro(11,:) soluble P loading from subbasin for year (kg P/ha)
subyro(12,:) groundwater loading from subbasin for year (mm H2O)
subyro(13,:) percolation out of soil profile in subbasin for year (mm H2O)
subyro(14,:) loading to reach of mineral P attached to sediment from subbasin for year (kg P/ha)

- real ∗8, dimension(:,:), allocatable hruaao

HRU average annual output array (varies)
hruaao(1,:) precipitation in HRU during simulation (mm H2O)
hruaao(2,:) amount of precipitation falling as freezing rain/snow in HRU during simulation (mm H2O)
hruaao(3,:) amount of snow melt in HRU during simulation (mm H2O)
hruaao(4,:) amount of surface runoff to main channel from HRU during simulation (ignores impact of transmission losses) (mm H2O)
hruaao(5,:) amount of lateral flow contribution to main channel from HRU during simulation (mm H2O)
hruaao(6,:) amount of groundwater flow contribution to main channel from HRU during simulation (mm H2O)
hruaao(7,:) amount of water moving from shallow aquifer to plants or soil profile in HRU during simulation (mm H2O)
hruaao(8,:) amount of water recharging deep aquifer in HRU during simulation (mm H2O)
hruaao(9,:) total amount of water entering both aquifers from HRU during simulation (mm H2O)
hruaao(10,:) water yield (total amount of water entering main channel) from HRU during simulation (mm H2O)
hruaao(11,:) amount of water percolating out of the soil profile and into the vadose zone in HRU during simulation (mm H2O)
hruaao(12,:) actual evapotranspiration in HRU during simulation
hruaao(13,:) amount of transmission losses from tributary channels in HRU for simulation (mm H2O)
hruaao(14,:) sediment yield from HRU for simulation (metric tons/ha)
hruaao(17,:) amount of nitrogen applied in continuous fertilizer operation in HRU for simulation (kg N/ha)
hruaao(18,:) amount of phosphorus applied in continuous fertilizer operation in HRU for simulation (kg P/ha)
hruaao(23,:) amount of water removed from shallow aquifer in HRU for irrigation during simulation (mm H2O)
hruaao(24,:) amount of water removed from deep aquifer in HRU for irrigation during simulation (mm H2O)
hruaao(25,:) potential evapotranspiration in HRU during simulation (mm H2O)
hruaao(26,:) annual amount of N (organic & mineral) applied in HRU during grazing (kg N/ha)
hruaao(27,:) annual amount of P (organic & mineral) applied in HRU during grazing (kg P/ha)
hruaao(28,:) average annual amount of N (organic & mineral) auto-applied in HRU (kg N/ha)
hruaao(29,:) average annual amount of P (organic & mineral) auto-applied in HRU (kg P/ha)
hruaao(31,:) water stress days in HRU during simulation (stress days)
hruaao(32,:) temperature stress days in HRU during simulation (stress days)
hruaao(33,:) nitrogen stress days in HRU during simulation (stress days)
hruaao(34,:) phosphorus stress days in HRU during simulation (stress days)
hruaao(35,:) organic nitrogen in surface runoff in HRU during simulation (kg N/ha)
hruaao(36,:) organic phosphorus in surface runoff in HRU during simulation (kg P/ha)
hruaao(37,:) nitrate in surface runoff in HRU during simulation (kg N/ha)
hruaao(38,:) nitrate in lateral flow in HRU during simulation (kg N/ha)
hruaao(39,:) soluble phosphorus in surface runoff in HRU during simulation (kg P/ha)
hruaao(40,:) amount of nitrogen removed from soil by plant uptake in HRU during simulation (kg N/ha)
hruaao(41,:) nitrate percolating past bottom of soil profile in HRU during simulation (kg N/ha)
hruaao(42,:) amount of phosphorus removed from soil by plant uptake in HRU during simulation (kg P/ha)
hruaao(43,:) amount of phosphorus moving from labile mineral to active mineral pool in HRU during simulation (kg P/ha)
hruaao(44,:) amount of phosphorus moving from active mineral to stable mineral pool in HRU during simulation (kg P/ha)
hruaao(45,:) amount of nitrogen applied to HRU in fertilizer and grazing operations during simulation (kg N/ha)
hruaao(46,:) amount of phosphorus applied to HRU in fertilizer and grazing operations during simulation (kg P/ha)
hruaao(47,:) amount of nitrogen added to soil by fixation in HRU during simulation (kg N/ha)
hruaao(48,:) amount of nitrogen lost by denitrification in HRU during simulation (kg N/ha)
hruaao(49,:) amount of nitrogen moving from active organic to nitrate pool in HRU during simulation (kg N/ha)
hruaao(50,:) amount of nitrogen moving from active organic to stable organic pool in HRU during simulation (kg N/ha)
hruaao(51,:) amount of phosphorus moving from organic to labile mineral pool in HRU during simulation (kg P/ha)
hruaao(52,:) amount of nitrogen moving from fresh organic to nitrate and active organic pools in HRU during simulation (kg N/ha)
hruaao(53,:) amount of phosphorus moving from fresh organic to the labile mineral and organic pools in HRU during simulation (kg P/ha)
hruaao(54,:) amount of nitrogen added to soil in rain during simulation (kg N/ha)

hruaao(61,:) daily soil loss predicted with USLE equation (metric tons/ha)
hruaao(63,:) less persistent bacteria transported to main channel from HRU during simulation (# bacteria/ha)
hruaao(64,:) persistent bacteria transported to main channel from HRU during simulation (# bacteria/ha)
hruaao(65,:) nitrate loading from groundwater in HRU to main channel during simulation (kg N/ha)
hruaao(66,:) soluble P loading from groundwater in HRU to main channel during simulation (kg P/ha)
hruaao(67,:) loading of mineral P attached to sediment in HRU to main channel during simulation (kg P/ha)

- real ∗8, dimension(:,:), allocatable subaao

  subbasin average annual output array (varies)

- real ∗8, dimension(:,:), allocatable resoutm

  reservoir monthly output array (varies)
  resoutm(1,:) flow into reservoir during month (m^3/s)
  resoutm(2,:) flow out of reservoir during month (m^3/s)
  resoutm(3,:) sediment entering reservoir during month (metric tons)
  resoutm(4,:) sediment leaving reservoir during month (metric tons)
  resoutm(5,:) sediment concentration in reservoir during month (mg/L)
  resoutm(6,:) pesticide entering reservoir during month (mg pst)
  resoutm(7,:) pesticide lost from reservoir through reactions during month (mg pst)
  resoutm(8,:) pesticide lost from reservoir through volatilization during month (mg pst)
  resoutm(9,:) pesticide moving from water to sediment through settling during month (mg pst)
  resoutm(10,:) pesticide moving from sediment to water through resuspension during month (mg pst)
  resoutm(11,:) pesticide moving from water to sediment through diffusion during month (mg pst)
  resoutm(12,:) pesticide lost from reservoir sediment layer through reactions during month (mg pst)
  resoutm(13,:) pesticide lost from reservoir sediment layer through burial during month (mg pst)
  resoutm(14,:) pesticide transported out of reservoir during month (mg pst)
  resoutm(15,:) pesticide concentration in reservoir water during month (mg pst/m^3)
  resoutm(16,:) pesticide concentration in reservoir sediment layer during month (mg pst/m^3)
  resoutm(17,:) evaporation from reservoir during month (m^3 H2O)
  resoutm(18,:) seepage from reservoir during month (m^3 H2O)
  resoutm(19,:) precipitation on reservoir during month (m^3 H2O)
  resoutm(22,:) organic N entering reservoir during month (kg N)
  resoutm(23,:) organic N leaving reservoir during month (kg N)
  resoutm(24,:) organic P entering reservoir during month (kg P)
  resoutm(25,:) organic P leaving reservoir during month (kg P)
  resoutm(26,:) nitrate entering reservoir during month (kg N)
  resoutm(27,:) nitrate leaving reservoir during month (kg N)
  resoutm(28,:) nitrite entering reservoir during month (kg N)
  resoutm(29,:) nitrite leaving reservoir during month (kg N)
  resoutm(30,:) ammonia entering reservoir during month (kg N)
  resoutm(31,:) ammonia leaving reservoir during month (kg N)
  resoutm(32,:) mineral P entering reservoir during month (kg P)
  resoutm(33,:) mineral P leaving reservoir during month (kg P)
  resoutm(34,:) chlorophyll-a entering reservoir during month (kg chla)
  resoutm(35,:) chlorophyll-a leaving reservoir during month (kg chla)
  resoutm(36,:) organic P concentration in reservoir water during month (mg P/L)
  resoutm(37,:) mineral P concentration in reservoir water during month (mg P/L)
  resoutm(38,:) organic N concentration in reservoir water during month (mg N/L)
  resoutm(39,:) nitrate concentration in reservoir water during month (mg N/L)
  resoutm(40,:) nitrite concentration in reservoir water during month (mg N/L)
  resoutm(41,:) ammonia concentration in reservoir water during month (mg N/L)

- real ∗8, dimension(:,:), allocatable resouty

  reservoir annual output array (varies)
  resouty(1,:) flow into reservoir during year (m^3/s)
  resouty(2,:) flow out of reservoir during year (m^3/s)
  resouty(3,:) sediment entering reservoir during year (metric tons)
  resouty(4,:) sediment leaving reservoir during year (metric tons)
  resouty(5,:) sediment concentration in reservoir during year (mg/L)
  resouty(6,:) pesticide entering reservoir during year (mg pst)
  resouty(7,:) pesticide lost from reservoir through reactions during year (mg pst)
  resouty(8,:) pesticide lost from reservoir through volatilization during year (mg pst)
  resouty(9,:) pesticide moving from water to sediment through settling during year (mg pst)
  resouty(10,:) pesticide moving from sediment to water through resuspension during year (mg pst)
  resouty(11,:) pesticide moving from water to sediment through diffusion during year (mg pst)

resouty(12,:) pesticide lost from reservoir sediment layer through reactions during year (mg pst)
resouty(13,:) pesticide lost from reservoir sediment layer through burial during year (mg pst)
resouty(14,:) pesticide transported out of reservoir during year (mg pst)
resouty(15,:) pesticide concentration in reservoir water during year (mg pst/m^3)
resouty(16,:) pesticide concentration in reservoir sediment layer during year (mg pst/m^3)
resouty(17,:) evaporation from reservoir during year (m^3 H2O)
resouty(18,:) seepage from reservoir during year (m^3 H2O)
resouty(19,:) precipitation on reservoir during year (m^3 H2O)
resouty(22,:) organic N entering reservoir during year (kg N)
resouty(23,:) organic N leaving reservoir during year (kg N)
resouty(24,:) organic P entering reservoir during year (kg P)
resouty(25,:) organic P leaving reservoir during year (kg P)
resouty(26,:) nitrate entering reservoir during year (kg N)
resouty(27,:) nitrate leaving reservoir during year (kg N)
resouty(28,:) nitrite entering reservoir during year (kg N)
resouty(29,:) nitrite leaving reservoir during year (kg N)
resouty(30,:) ammonia entering reservoir during year (kg N)
resouty(31,:) ammonia leaving reservoir during year (kg N)
resouty(32,:) mineral P entering reservoir during year (kg P)
resouty(33,:) mineral P leaving reservoir during year (kg P)
resouty(34,:) chlorophyll-a entering reservoir during year (kg chla)
resouty(35,:) chlorophyll-a leaving reservoir during year (kg chla)
resouty(36,:) organic P concentration in reservoir water during year (mg P/L)
resouty(37,:) mineral P concentration in reservoir water during year (mg P/L)
resouty(38,:) organic N concentration in reservoir water during year (mg N/L)
resouty(39,:) nitrate concentration in reservoir water during year (mg N/L)
resouty(40,:) nitrite concentration in reservoir water during year (mg N/L)
resouty(41,:) ammonia concentration in reservoir water during year (mg N/L)

- real ∗8, dimension(:,:), allocatable resouta

  reservoir average annual output array (varies)
  resouta(3,:) sediment entering reservoir during simulation (metric tons)
  resouta(4,:) sediment leaving reservoir during simulation (metric tons)
  resouta(17,:) evaporation from reservoir during simulation (m^3 H2O)
  resouta(18,:) seepage from reservoir during simulation (m^3 H2O)
  resouta(19,:) precipitation on reservoir during simulation (m^3 H2O)
  resouta(20,:) water entering reservoir during simulation (m^3 H2O)
  resouta(21,:) water leaving reservoir during simulation (m^3 H2O)

- real ∗8, dimension(12, 8) wshd_aamon

  wshd_aamon(:,1) average annual precipitation in watershed falling during month (mm H2O)
  wshd_aamon(:,2) average annual freezing rain in watershed falling during month (mm H2O)
  wshd_aamon(:,3) average annual surface runoff in watershed during month (mm H2O)
  wshd_aamon(:,4) average annual lateral flow in watershed during month (mm H2O)
  wshd_aamon(:,5) average annual water yield in watershed during month (mm H2O)
  wshd_aamon(:,6) average annual actual evapotranspiration in watershed during month (mm H2O)
  wshd_aamon(:,7) average annual sediment yield in watershed during month (metric tons)
  wshd_aamon(:,8) average annual potential evapotranspiration in watershed during month (mm H2O)

- real ∗8, dimension(:,:), allocatable wtrmon

  HRU monthly output data array for impoundments (varies)
  wtrmon(1,:) evaporation from ponds in HRU for month (mm H2O)
  wtrmon(2,:) seepage from ponds in HRU for month (mm H2O)
  wtrmon(3,:) precipitation on ponds in HRU for month (mm H2O)
  wtrmon(4,:) amount of water entering ponds in HRU for month (mm H2O)
  wtrmon(5,:) sediment entering ponds in HRU for month (metric tons/ha)
  wtrmon(6,:) amount of water leaving ponds in HRU for month (mm H2O)
  wtrmon(7,:) sediment leaving ponds in HRU for month (metric tons/ha)
  wtrmon(8,:) precipitation on wetlands in HRU for month (mm H2O)
  wtrmon(9,:) volume of water entering wetlands from HRU for month (mm H2O)
  wtrmon(10,:) sediment loading to wetlands for month from HRU (metric tons/ha)
  wtrmon(11,:) evaporation from wetlands in HRU for month (mm H2O)
  wtrmon(12,:) seeepage from wetlands in HRU for month (mm H2O)
  wtrmon(13,:) volume of water leaving wetlands in HRU for month (mm H2O)
  wtrmon(14,:) sediment loading from wetlands in HRU to main channel during month (metric tons/ha)

wtrmon(15,:) precipitation on potholes in HRU for month (mm H2O)
wtrmon(16,:) evaporation from potholes in HRU for month (mm H2O)
wtrmon(17,:) seepage from potholes in HRU for month (mm H2O)
wtrmon(18,:) water leaving potholes in HRU for month (mm H2O)
wtrmon(19,:) water entering potholes in HRU for month (mm H2O)
wtrmon(20,:) sediment entering potholes in HRU for month (metric tons/ha)
wtrmon(21,:) sediment leaving potholes in HRU for month (metric tons/ha)

- real ∗8, dimension(:,:), allocatable wtryr

  HRU impoundment annual output array (varies)
  wtryr(1,:) evaporation from ponds in HRU for year (mm H20)
  wtryr(2,:) seepage from ponds in HRU for year (mm H20)
  wtryr(3,:) precipitation on ponds in HRU for year (mm H20)
  wtryr(4,:) amount of water entering ponds in HRU for year (mm H20)
  wtryr(5,:) sediment entering ponds in HRU for year (metric tons/ha)
  wtryr(6,:) amount of water leaving ponds in HRU for year (mm H20)
  wtryr(7,:) sediment leaving ponds in HRU for year (metric tons/ha)
  wtryr(8,:) precipitation on wetlands in HRU for year (mm H20)
  wtryr(9,:) volume of water entering wetlands from HRU for year (mm H20)
  wtryr(10,:) sediment loading to wetlands for year from HRU (metric tons/ha)
  wtryr(11,:) evaporation from wetlands in HRU for year (mm H20)
  wtryr(12,:) seeepage from wetlands in HRU for year (mm H20)
  wtryr(13,:) volume of water leaving wetlands in HRU for year (mm H20)
  wtryr(14,:) sediment loading from wetlands in HRU to main channel during year (metric tons/ha)
  wtryr(15,:) precipitation on potholes in HRU during year (mm H20)
  wtryr(16,:) evaporation from potholes in HRU during year (mm H20)
  wtryr(17,:) seepage from potholes in HRU during year (mm H20)
  wtryr(18,:) water leaving potholes in HRU during year (mm H20)
  wtryr(19,:) water entering potholes in HRU during year (mm H20)
  wtryr(20,:) sediment entering potholes in HRU during year (metric tons/ha)
  wtryr(21,:) sediment leaving potholes in HRU during year (metric tons/ha)

- real ∗8, dimension(:,:), allocatable wtraa

  HRU impoundment average annual output array (varies)

- real ∗8, dimension(:,:), allocatable sub_smfmx

  max melt rate for snow during year (June 21) for subbasin(:) where deg C refers to the air temperature. SUB_SMFMX and SMFMN allow the rate of snow melt to vary through the year. These parameters are accounting for the impact of soil temperature on snow melt (range: -5.0/5.0) (mm/deg C/day)

- real ∗8, dimension(:,:), allocatable sub_smfmn

  min melt rate for snow during year (Dec 21) for subbasin(:) (range: -5.0/5.0) where deg C refers to the air temperature (mm/deg C/day)

- real ∗8, dimension(:,:,:), allocatable hrupstd

  hrupstd(1,:,:) amount of pesticide type in surface runoff contribution to stream from HRU on day (in solution) (mg pst)
  hrupstd(2,:,:) amount of pesticide type in surface runoff contribution to stream from HRU on day (sorbed to sediment) (mg pst)
  hrupstd(3,:,:) total pesticide loading to stream in surface runoff from HRU (mg pst/ha)
  hrupstd(4,:,:) amount of pesticide type in lateral flow contribution to stream from HRU on day (in solution) (mg pst)

- real ∗8, dimension(:,:,:), allocatable hrupstm

  hrupstm(:,:,:)HRU monthly pesticide output array (varies)
  hrupstm(1,:,:) amount of pesticide type in surface runoff contribution to stream from HRU during month (in solution) (mg pst)
  hrupstm(2,:,:) amount of pesticide type in surface runoff contribution to stream from HRU during month (sorbed to sediment) (mg pst)
  hrupstm(3,:,:) total pesticide loading to stream in surface runoff from HRU during month (mg pst)

- real ∗8, dimension(:,:,:), allocatable hrupsta

  HRU average annual pesticide output array (varies)

- real ∗8, dimension(:,:,:), allocatable hrupsty

  hrupsty(:,:,:) HRU annual pesticide output array (varies)
  hrupsty(1,:,:) amount of pesticide type in surface runoff contribution to stream from HRU during year (in solution) (mg pst)
  hrupsty(2,:,:) amount of pesticide type in surface runoff contribution to stream from HRU during year (sorbed to sediment) (mg pst)

- integer, dimension(:), allocatable ifirstt

  temperature data search code (none)
  0 first day of temperature data located in file
  1 first day of temperature data not located in file
- integer, dimension(:), allocatable **ifirstpcp**
- integer, dimension(:), allocatable elevp

  elevation of precipitation gage station (m)
- integer, dimension(:), allocatable elevt

  elevation of temperature gage station (m)
- real ∗8, dimension(:,:), allocatable ftmpmn

  avg monthly minimum air temperature (deg C)
- real ∗8, dimension(:,:), allocatable ftmpmx

  avg monthly maximum air temperature (deg C)
- real ∗8, dimension(:,:), allocatable ftmpstdmn

  standard deviation for avg monthly minimum air temperature (deg C)
- real ∗8, dimension(:,:), allocatable ftmpstdmx

  standard deviation for avg monthly maximum air temperature (deg C)
- real ∗8, dimension(:,:,:), allocatable fpcp_stat

  fpcp_stat(:,1,:): average amount of precipitation falling in one day for the month (mm/day)
  fpcp_stat(:,2,:): standard deviation for the average daily precipitation (mm/day)
  fpcp_stat(:,3,:): skew coefficient for the average daily precipitationa (none)
- real ∗8, dimension(:,:), allocatable fpr_w1

  probability of wet day after dry day in month (none)
- real ∗8, dimension(:,:), allocatable fpr_w2

  probability of wet day after wet day in month (none)
- real ∗8, dimension(:,:), allocatable fpr_w3

  proportion of wet days in the month (none)
- real ∗8, dimension(:), allocatable ch_d

  average depth of main channel (m)
- real ∗8, dimension(:), allocatable flwin

  flow into reach on current day (m^3 H2O)
- real ∗8, dimension(:), allocatable flwout

  flow out of reach on current day (m^3 H2O)
- real ∗8, dimension(:), allocatable bankst

  bank storage (m^3 H2O)
- real ∗8, dimension(:), allocatable **ch_wi**
- real ∗8, dimension(:), allocatable ch_onco

  channel organic n concentration (ppm)
- real ∗8, dimension(:), allocatable ch_opco

  channel organic p concentration (ppm)
- real ∗8, dimension(:), allocatable **ch_orgn**
- real ∗8, dimension(:), allocatable **ch_orgp**
- real ∗8, dimension(:), allocatable drift

  amount of pesticide drifting onto main channel in subbasin (kg)
- real ∗8, dimension(:), allocatable rch_dox

  dissolved oxygen concentration in reach (mg O2/L)
- real ∗8, dimension(:), allocatable rch_bactp

  persistent bacteria in reach/outflow at end of day (# cfu/100ml)
- real ∗8, dimension(:), allocatable alpha_bnk

  alpha factor for bank storage recession curve (days)
- real ∗8, dimension(:), allocatable alpha_bnke

  $\exp(-alpha_bnk)$ *(none)*

- real ∗8, dimension(:), allocatable rchstor

  water stored in reach (m^3 H2O)
- real ∗8, dimension(:), allocatable sedst

  amount of sediment stored in reach (metric tons)
- real ∗8, dimension(:), allocatable algae

  algal biomass concentration in reach (mg alg/L)
- real ∗8, dimension(:), allocatable disolvp

  dissolved phosphorus concentration in reach (mg P/L)
- real ∗8, dimension(:), allocatable chlora

  chlorophyll-a concentration in reach (mg chl-a/L)
- real ∗8, dimension(:), allocatable organicn

  organic nitrogen concentration in reach (mg N/L)
- real ∗8, dimension(:), allocatable organicp

  organic phosphorus concentration in reach (mg P/L)
- real ∗8, dimension(:), allocatable ch_li

  initial length of main channel (km)
- real ∗8, dimension(:), allocatable ch_si

  initial slope of main channel (m/m)
- real ∗8, dimension(:), allocatable nitraten

  nitrate concentration in reach (mg N/L)
- real ∗8, dimension(:), allocatable nitriten

  nitrite concentration in reach (mg N/L)
- real ∗8, dimension(:), allocatable **ch_bnk_san**
- real ∗8, dimension(:), allocatable **ch_bnk_sil**
- real ∗8, dimension(:), allocatable **ch_bnk_cla**
- real ∗8, dimension(:), allocatable **ch_bnk_gra**
- real ∗8, dimension(:), allocatable **ch_bed_san**
- real ∗8, dimension(:), allocatable **ch_bed_sil**
- real ∗8, dimension(:), allocatable **ch_bed_cla**
- real ∗8, dimension(:), allocatable **ch_bed_gra**
- real ∗8, dimension(:), allocatable **depfp**
- real ∗8, dimension(:), allocatable **depsanfp**
- real ∗8, dimension(:), allocatable **depsilfp**
- real ∗8, dimension(:), allocatable **depclafp**
- real ∗8, dimension(:), allocatable **depsagfp**
- real ∗8, dimension(:), allocatable **deplagfp**
- real ∗8, dimension(:), allocatable **depch**
- real ∗8, dimension(:), allocatable **depsanch**
- real ∗8, dimension(:), allocatable **depsilch**
- real ∗8, dimension(:), allocatable **depclach**
- real ∗8, dimension(:), allocatable **depsagch**
- real ∗8, dimension(:), allocatable **deplagch**
- real ∗8, dimension(:), allocatable **depgrach**
- real ∗8, dimension(:), allocatable **depgrafp**
- real ∗8, dimension(:), allocatable **grast**
- real ∗8, dimension(:), allocatable r2adj

  curve number retention parameter adjustment factor to adjust surface runoff for flat slopes (0.5 - 3.0) (dimensionless)
- real ∗8, dimension(:), allocatable prf

  Reach peak rate adjustment factor for sediment routing in the channel. Allows impact of peak flow rate on sediment routing and channel reshaping to be taken into account (none)
- real ∗8, dimension(:), allocatable **depprch**
- real ∗8, dimension(:), allocatable **depprfp**
- real ∗8, dimension(:), allocatable spcon

linear parameter for calculating sediment reentrained in channel sediment routing

- real ∗8, dimension(:), allocatable spexp

  exponent parameter for calculating sediment reentrained in channel sediment routing

- real ∗8, dimension(:), allocatable **sanst**
- real ∗8, dimension(:), allocatable **silst**
- real ∗8, dimension(:), allocatable **clast**
- real ∗8, dimension(:), allocatable **sagst**
- real ∗8, dimension(:), allocatable **lagst**
- real ∗8, dimension(:), allocatable **pot_san**
- real ∗8, dimension(:), allocatable **pot_sil**
- real ∗8, dimension(:), allocatable **pot_cla**
- real ∗8, dimension(:), allocatable **pot_sag**
- real ∗8, dimension(:), allocatable **pot_lag**
- real ∗8, dimension(:), allocatable **potsani**
- real ∗8, dimension(:), allocatable **potsili**
- real ∗8, dimension(:), allocatable **potclai**
- real ∗8, dimension(:), allocatable **potsagi**
- real ∗8, dimension(:), allocatable **potlagi**
- real ∗8, dimension(:), allocatable **sanyld**
- real ∗8, dimension(:), allocatable **silyld**
- real ∗8, dimension(:), allocatable **clayld**
- real ∗8, dimension(:), allocatable **sagyld**
- real ∗8, dimension(:), allocatable **lagyld**
- real ∗8, dimension(:), allocatable **grayld**
- real ∗8, dimension(:), allocatable **res_san**
- real ∗8, dimension(:), allocatable **res_sil**
- real ∗8, dimension(:), allocatable **res_cla**
- real ∗8, dimension(:), allocatable **res_sag**
- real ∗8, dimension(:), allocatable **res_lag**
- real ∗8, dimension(:), allocatable **res_gra**
- real ∗8, dimension(:), allocatable **pnd_san**
- real ∗8, dimension(:), allocatable **pnd_sil**
- real ∗8, dimension(:), allocatable **pnd_cla**
- real ∗8, dimension(:), allocatable **pnd_sag**
- real ∗8, dimension(:), allocatable **pnd_lag**
- real ∗8, dimension(:), allocatable **wet_san**
- real ∗8, dimension(:), allocatable **wet_sil**
- real ∗8, dimension(:), allocatable **wet_cla**
- real ∗8, dimension(:), allocatable **wet_lag**
- real ∗8, dimension(:), allocatable **wet_sag**
- real ∗8 **ressano**
- real ∗8 **ressilo**
- real ∗8 **resclao**
- real ∗8 **ressago**
- real ∗8 **reslago**
- real ∗8 **resgrao**
- real ∗8 **ressani**
- real ∗8 **ressili**
- real ∗8 **resclai**
- real ∗8 **ressagi**
- real ∗8 **reslagi**
- real ∗8 **resgrai**
- real ∗8 **potsano**
- real ∗8 **potsilo**

- real ∗8 **potclao**
- real ∗8 **potsago**
- real ∗8 **potlago**
- real ∗8 **pndsanin**
- real ∗8 **pndsilin**
- real ∗8 **pndclain**
- real ∗8 **pndsagin**
- real ∗8 **pndlagin**
- real ∗8 **pndsano**
- real ∗8 **pndsilo**
- real ∗8 **pndclao**
- real ∗8 **pndsago**
- real ∗8 **pndlago**
- real ∗8, dimension(:), allocatable ch_di

  initial depth of main channel (m)
- real ∗8, dimension(:), allocatable ch_erod

  channel erodibility factor (0.0-1.0) (none)
  0 non-erosive channel
  1 no resistance to erosion
- real ∗8, dimension(:,:), allocatable ch_l

  ch_l(1,:) longest tributary channel length in subbasin (km)
  ch_l(2,:) length of main channel (km)
- real ∗8, dimension(:), allocatable **ch_cov**
- real ∗8, dimension(:), allocatable ch_bnk_bd

  bulk density of channel bank sediment (1.1-1.9) (g/cc)
- real ∗8, dimension(:), allocatable ch_bed_bd

  bulk density of channel bed sediment (1.1-1.9) (g/cc)
- real ∗8, dimension(:), allocatable ch_bnk_kd

  erodibility of channel bank sediment by jet test (Peter Allen needs to give more info on this)
- real ∗8, dimension(:), allocatable ch_bed_kd

  erodibility of channel bed sediment by jet test (Peter Allen needs to give more info on this)
- real ∗8, dimension(:), allocatable ch_bnk_d50

  D50(median) particle size diameter of channel bank sediment (0.001 - 20)
- real ∗8, dimension(:), allocatable ch_bed_d50

  D50(median) particle size diameter of channel bed sediment (micrometers) (0.001 - 20)
- real ∗8, dimension(:), allocatable ch_cov1

  channel erodibility factor (0.0-1.0) (none)
  0 non-erosive channel
  1 no resistance to erosion
- real ∗8, dimension(:), allocatable ch_cov2

  channel cover factor (0.0-1.0) (none)
  0 channel is completely protected from erosion by cover
  1 no vegetative cover on channel
- real ∗8, dimension(:), allocatable tc_bed

  critical shear stress of channel bed (N/m2)
- real ∗8, dimension(:), allocatable tc_bnk

  critical shear stress of channel bank (N/m2)
- integer, dimension(:), allocatable ch_eqn

  sediment routine methods (DAILY):
  0 = original SWAT method
  1 = Bagnold's
  2 = Kodatie
  3 = Molinas WU
  4 = Yang

- real ∗8, dimension(:), allocatable chpst_rea

  pesticide reaction coefficient in reach (1/day)
- real ∗8, dimension(:), allocatable chpst_vol

  pesticide volatilization coefficient in reach (m/day)
- real ∗8, dimension(:), allocatable chpst_conc

  initial pesticide concentration in reach (mg/(m^3))
- real ∗8, dimension(:), allocatable chpst_koc

  pesticide partition coefficient between water and sediment in reach (m^3/g)
- real ∗8, dimension(:), allocatable chpst_rsp

  resuspension velocity in reach for pesticide sorbed to sediment (m/day)
- real ∗8, dimension(:), allocatable chpst_stl

  settling velocity in reach for pesticide sorbed to sediment (m/day)
- real ∗8, dimension(:), allocatable ch_wdr

  channel width to depth ratio (m/m)
- real ∗8, dimension(:), allocatable chpst_mix

  mixing velocity (diffusion/dispersion) for pesticide in reach (m/day)
- real ∗8, dimension(:), allocatable sedpst_conc

  inital pesticide concentration in river bed sediment (mg/m^3)
- real ∗8, dimension(:), allocatable sedpst_bry

  pesticide burial velocity in river bed sediment (m/day)
- real ∗8, dimension(:), allocatable sedpst_rea

  pesticide reaction coefficient in river bed sediment (1/day)
- real ∗8, dimension(:), allocatable sedpst_act

  depth of active sediment layer in reach for pesticide (m)
- real ∗8, dimension(:), allocatable rch_cbod

  carbonaceous biochemical oxygen demand in reach (mg O2/L)
- real ∗8, dimension(:), allocatable rch_bactlp

  less persistent bacteria in reach/outflow at end of day (# cfu/100ml)
- real ∗8, dimension(:), allocatable chside

  change in horizontal distance per unit vertical distance (0.0 - 5)
  0 = for vertical channel bank
  5 = for channel bank with gentl side slope
- real ∗8, dimension(:), allocatable rs1

  local algal settling rate in reach at 20 deg C (m/day or m/hour)
- real ∗8, dimension(:), allocatable rs2

  benthos source rate for dissolved phosphorus in reach at 20 deg C ((mg disP-P)/(m^2∗day) or (mg dis↩ P-P)/(m^2∗hour))
- real ∗8, dimension(:), allocatable rs3

  benthos source rate for ammonia nitrogen in reach at 20 deg C ((mg NH4-N)/(m^2∗day) or (mg NH4-N)/(m^2∗hour))
- real ∗8, dimension(:), allocatable rs4

  rate coefficient for organic nitrogen settling in reach at 20 deg C (1/day or 1/hour)
- real ∗8, dimension(:), allocatable rs5

  organic phosphorus settling rate in reach at 20 deg C (1/day or 1/hour)
- real ∗8, dimension(:), allocatable rk1

  CBOD deoxygenation rate coefficient in reach at 20 deg C (1/day or 1/hour)
- real ∗8, dimension(:), allocatable rk2

  reaeration rate in accordance with Fickian diffusion in reach at 20 deg C (1/day or 1/hour)
- real ∗8, dimension(:), allocatable rk3

  rate of loss of CBOD due to settling in reach at 20 deg C (1/day or 1/hour)
- real ∗8, dimension(:), allocatable rk4

  sediment oxygen demand rate in reach at 20 deg C (mg O2/(m^2∗day) or mg O2/(m^2∗hour))

- real ∗8, dimension(:), allocatable rk5

    coliform die-off rate in reach (1/day)
- real ∗8, dimension(:), allocatable rs6

    rate coefficient for settling of arbitrary non-conservative constituent in reach (1/day)
- real ∗8, dimension(:), allocatable rs7

    benthal source rate for arbitrary non-conservative constituent in reach ((mg ANC)/(m^2∗day))
- real ∗8, dimension(:), allocatable bc1

    rate constant for biological oxidation of NH3 to NO2 in reach at 20 deg C (1/day or 1/hour)
- real ∗8, dimension(:), allocatable bc2

    rate constant for biological oxidation of NO2 to NO3 in reach at 20 deg C (1/day or 1/hour)
- real ∗8, dimension(:), allocatable bc3

    rate constant for hydrolysis of organic N to ammonia in reach at 20 deg C (1/day or 1/hour)
- real ∗8, dimension(:), allocatable bc4

    rate constant for the decay of organic P to dissolved P in reach at 20 deg C (1/day or 1/hour)
- real ∗8, dimension(:), allocatable rk6

    decay rate for arbitrary non-conservative constituent in reach (1/day)
- real ∗8, dimension(:), allocatable ammonian

    ammonia concentration in reach (mg N/L)
- real ∗8, dimension(:), allocatable **orig_sedpstconc**
- real ∗8, dimension(:,:), allocatable wurch

    average daily water removal from the reach for the month (10^4 m^3/day)
- integer, dimension(:), allocatable **icanal**
- integer, dimension(:), allocatable **itb**
- real ∗8, dimension(:), allocatable ch_revap

    revap coeff: this variable controls the amount of water moving from bank storage to the root zone as a result of soil moisture depletion (none)
- real ∗8, dimension(:), allocatable **dep_chan**
- real ∗8, dimension(:), allocatable harg_petco

    coefficient related to radiation used in hargreaves eq (range: 0.0019 - 0.0032)
- real ∗8, dimension(:), allocatable **subfr_nowtr**
- real ∗8, dimension(:), allocatable cncoef_sub

    soil water depletion coefficient used in the new (modified curve number method) same as soil index coeff used in APEX range: 0.5 - 2.0
- real ∗8, dimension(:), allocatable **dr_sub**
- real ∗8, dimension(:), allocatable sub_fr

    fraction of total watershed area contained in subbasin (km2/km2)
- real ∗8, dimension(:), allocatable sub_sw

    amount of water in soil profile in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable sub_minp

    amount of phosphorus stored in all mineral pools sorbed to sediment (kg P/ha)
- real ∗8, dimension(:), allocatable **wcklsp**
- real ∗8, dimension(:), allocatable sub_gwno3

    nitrate loading in groundwater from subbasin (kg N/ha)
- real ∗8, dimension(:), allocatable sub_sumfc

    amount of water in soil at field capacity in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable **sub_gwsolp**
- real ∗8, dimension(:), allocatable co2

    CO2 concentration (ppmv)
- real ∗8, dimension(:), allocatable sub_km

    area of subbasin in square kilometers (km^2)
- real ∗8, dimension(:), allocatable wlat

    latitude of weather station used to compile data (degrees)

- real ∗8, dimension(:), allocatable sub_tc

  time of concentration for subbasin (hour)
- real ∗8, dimension(:), allocatable sub_pet

  potential evapotranspiration for day in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable welev

  elevation of weather station used to compile weather generator data (m)
- real ∗8, dimension(:), allocatable sub_bd

  average bulk density in subbasin for top 10 mm of first soil layer (Mg/m^3)
- real ∗8, dimension(:), allocatable sub_orgn

  amount of nitrogen stored in all organic pools (kg N/ha)
- real ∗8, dimension(:), allocatable sub_orgp

  amount of phosphorus stored in all organic pools (kg P/ha)
- real ∗8, dimension(:), allocatable sub_sedpa

  amount of active mineral P attached to sediment removed in surface runoff on day in subbasin (kg P/ha)
- real ∗8, dimension(:), allocatable sub_sedps

  amount of stable mineral P attached to sediment removed in surface runoff on day in subbasin (kg P/ha)
- real ∗8, dimension(:), allocatable **sub_wtmp**
- real ∗8, dimension(:), allocatable daylmn

  shortest daylength occurring during the year (hour)
- real ∗8, dimension(:), allocatable sub_minpa

  amount of phosphorus stored in active mineral pools sorbed to sediment (kg P/ha)
- real ∗8, dimension(:), allocatable sub_minps

  amount of phosphorus stored in stable mineral pools sorbed to sediment (kg P/ha)
- real ∗8, dimension(:), allocatable latcos

  $\cos(latitude)$ *(none)*
- real ∗8, dimension(:), allocatable latsin

  $\sin(latitude)$ *(none)*
- real ∗8, dimension(:), allocatable phutot

  total potential heat units for year (used when no crop is growing) (heat unit)
- real ∗8, dimension(:), allocatable plaps

  precipitation lapse rate: precipitation change due to change in elevation (mm H2O/km)
- real ∗8, dimension(:), allocatable tlaps

  temperature lapse rate: temperature change due to change in elevation (deg C/km)
- real ∗8, dimension(:), allocatable tmp_an

  average annual air temperature (deg C)
- real ∗8, dimension(:), allocatable sub_precip

  effective precipitation (amount of water reaching soil surface) for the day in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable rammo_sub

  atmospheric deposition of ammonium values for entire watershed (mg/l)
- real ∗8, dimension(:), allocatable rcn_sub

  atmospheric deposition of nitrate for entire watershed (mg/l)
- real ∗8, dimension(:), allocatable **pcpdays**
- real ∗8, dimension(:), allocatable **atmo_day**
- real ∗8, dimension(:), allocatable sub_snom

  amount of snow melt in subbasin on day (mm H2O)
- real ∗8, dimension(:), allocatable sub_qd

  surface runoff that reaches main channel during day in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable sub_sedy

  sediment yield for the day in subbasin (metric tons)
- real ∗8, dimension(:), allocatable sub_tran

  transmission losses on day in subbasin (mm H2O)

- real ∗8, dimension(:), allocatable sub_no3

  NO3-N in surface runoff on day in subbasin (kg N/ha)
- real ∗8, dimension(:), allocatable sub_latno3

  NO3-N in lateral flow on day in subbasin (kg N/ha)
- real ∗8, dimension(:,:), allocatable sub_sftmp

  snowfall temperature for subbasin(:). Mean air temperature at which precip is equally likely to be rain as snow/freezing rain (range: -5.0/5.0) (deg C)
- real ∗8, dimension(:,:), allocatable sub_smtmp

  snow melt base temperature for subbasin(:) mean air temperature at which snow melt will occur (range: -5.0/5.0) (deg C)
- real ∗8, dimension(:,:), allocatable sub_timp

  snow pack temperature lag factor (0-1) (none)
  1 = no lag (snow pack temp=current day air temp) as the lag factor goes to zero, the snow pack's temperature will be less influenced by the current day's air temperature
- real ∗8, dimension(:), allocatable **sub_tileno3**
- real ∗8, dimension(:), allocatable sub_etday

  actual evapotranspiration on day in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable sub_solp

  soluble P in surface runoff on day in subbasin (kg P/ha)
- real ∗8, dimension(:), allocatable sub_subp

  precipitation for day in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable sub_elev

  average elevation of HRU (m)
- real ∗8, dimension(:), allocatable sub_surfq

  surface runoff generated on day in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable sub_wyld

  water yield on day in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable **qird**
- real ∗8, dimension(:), allocatable sub_gwq

  groundwater flow on day in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable sub_sep

  seepage from bottom of soil profile on day in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable sub_chl

  chlorophyll-a in water yield on day in subbasin (kg chl-a)
- real ∗8, dimension(:), allocatable sub_cbod

  carbonaceous biological oxygen demand on day for subbasin (kg O2)
- real ∗8, dimension(:), allocatable sub_dox

  dissolved oxygen loading on day for subbasin (kg O2)
- real ∗8, dimension(:), allocatable sub_solpst

  pesticide in solution in surface runoff on day in subbasin (mg pst)
- real ∗8, dimension(:), allocatable sub_yorgn

  organic N in surface runoff on day in subbasin (kg P/ha)
- real ∗8, dimension(:), allocatable sub_yorgp

  organic P in surface runoff on day in subbasin (kg P/ha)
- real ∗8, dimension(:), allocatable sub_sorpst

  pesticide sorbed to sediment in surface runoff on day in subbasin (mg pst)
- real ∗8, dimension(:), allocatable sub_lat

  latitude of HRU/subbasin (degrees)
- real ∗8, dimension(:), allocatable sub_bactlp

  less persistent bacteria in surface runoff for day in subbasin (# cfu/m^2)
- real ∗8, dimension(:), allocatable sub_bactp

persistent bacteria in surface runoff for day in subbasin (# cfu/m^ 2)

- real ∗8, dimension(:), allocatable **sub_latq**
- real ∗8, dimension(:), allocatable **sub_gwq_d**
- real ∗8, dimension(:), allocatable **sub_tileq**
- real ∗8, dimension(:), allocatable **sub_vaptile**
- real ∗8, dimension(:), allocatable **sub_dsan**
- real ∗8, dimension(:), allocatable **sub_dsil**
- real ∗8, dimension(:), allocatable **sub_dcla**
- real ∗8, dimension(:), allocatable **sub_dsag**
- real ∗8, dimension(:), allocatable **sub_dlag**
- real ∗8 **vap_tile**
- real ∗8, dimension(:), allocatable **wnan**
- real ∗8, dimension(:,:), allocatable **sol_stpwt**
- real ∗8, dimension(:,:), allocatable sub_pst

  amount of pesticide in soil layer in subbasin (kg/ha)
- real ∗8, dimension(:,:), allocatable sub_hhwtmp

  water temperature for the time step in subbasin (deg C)
- real ∗8, dimension(:,:), allocatable **sub_hhqd**
- real ∗8, dimension(:,:), allocatable huminc

  monthly humidity adjustment. Daily values for relative humidity within the month are rasied or lowered by the specified amount (used in climate change studies) (none)
- real ∗8, dimension(:,:), allocatable radinc

  monthly solar radiation adjustment. Daily radiation within the month is raised or lowered by the specified amount (used in climate change studies) (MJ/m^ 2)
- real ∗8, dimension(:,:), allocatable rfinc

  monthly rainfall adjustment. Daily rainfall within the month is adjusted to the specified percentage of the original value (used in climate change studies)(%)
- real ∗8, dimension(:,:), allocatable tmpinc

  monthly temperature adjustment. Daily maximum and minimum temperatures within the month are raised or lowered by the specified amount (used in climate change studies) (deg C)
- real ∗8, dimension(:,:), allocatable ch_k

  ch_k(1,:) effective hydraulic conductivity of tributary channel alluvium (mm/hr)
  ch_k(2,:) effective hydraulic conductivity of main channel alluvium (mm/hr)
- real ∗8, dimension(:,:), allocatable elevb

  elevation at the center of the band in subbasin (m)
- real ∗8, dimension(:,:), allocatable elevb_fr

  fraction of subbasin area within elevation band (the same fractions should be listed for all HRUs within the subbasin) (none)
- real ∗8, dimension(:,:), allocatable wndav

  average wind speed for the month (m/s)
- real ∗8, dimension(:,:), allocatable ch_n

  ch_n(1,:) Manning's "n" value for the tributary channels (none)
  ch_n(2,:) Manning's "n" value for the main channel (none)
- real ∗8, dimension(:,:), allocatable ch_s

  ch_s(1,:) average slope of tributary channels (m/m)
  ch_s(2,:) average slope of main channel (m/m)
- real ∗8, dimension(:,:), allocatable ch_w

  ch_w(1,:) average width of tributary channels (m)
  ch_w(2,:) average width of main channel (m)
- real ∗8, dimension(:,:), allocatable dewpt

  average dew point temperature for the month (deg C)
- real ∗8, dimension(:,:), allocatable amp_r

  average fraction of total daily rainfall occuring in maximum half-hour period for month (none)

- real ∗8, dimension(:,:), allocatable solarav

  average daily solar radiation for the month (MJ/m^2/day)
- real ∗8, dimension(:,:), allocatable tmpstdmx

  standard deviation for avg monthly maximum air temperature (deg C)
- real ∗8, dimension(:,:), allocatable pcf

  normalization coefficient for precipitation generated from skewed distribution (none)
- real ∗8, dimension(:,:), allocatable tmpmn

  avg monthly minimum air temperature (deg C)
- real ∗8, dimension(:,:), allocatable tmpmx

  avg monthly maximum air temperature (deg C)
- real ∗8, dimension(:,:), allocatable tmpstdmn

  standard deviation for avg monthly minimum air temperature (deg C)
- real ∗8, dimension(:,:), allocatable **otmpstdmn**
- real ∗8, dimension(:,:), allocatable **otmpmn**
- real ∗8, dimension(:,:), allocatable **otmpmx**
- real ∗8, dimension(:,:), allocatable **otmpstdmx**
- real ∗8, dimension(:,:), allocatable **ch_erodmo**
- real ∗8, dimension(:,:), allocatable **uh**
- real ∗8, dimension(:,:), allocatable **hqdsave**
- real ∗8, dimension(:,:), allocatable **hsdsave**
- real ∗8, dimension(:,:), allocatable pr_w1

  probability of wet day after dry day in month (none)
- real ∗8, dimension(:,:), allocatable pr_w2

  probability of wet day after wet day in month (none)
- real ∗8, dimension(:,:), allocatable pr_w3

  proportion of wet days in the month (none)
- real ∗8, dimension(:,:,:), allocatable **pcp_stat**
- real ∗8, dimension(:,:), allocatable **opr_w1**
- real ∗8, dimension(:,:), allocatable **opr_w2**
- real ∗8, dimension(:,:), allocatable **opr_w3**
- real ∗8, dimension(:,:,:), allocatable **opcp_stat**
- integer, dimension(:), allocatable ireg

  precipitation category (none):
  1 precipitation <= 508 mm/yr
  2 precipitation > 508 and <= 1016 mm/yr
  3 precipitation > 1016 mm/yr
- integer, dimension(:), allocatable hrutot

  number of HRUs in subbasin (none)
- integer, dimension(:), allocatable **hru1**
- integer, dimension(:), allocatable ihgage

  HRU relative humidity data code (gage # for relative humidity data used in as HRU) (none)
- integer, dimension(:), allocatable isgage

  HRU solar radiation data code (record # for solar radiation used in HRU) (none)
- integer, dimension(:), allocatable iwgage

  HRU wind speed gage data code (gage # for wind speed data used in HRU) (none)
- integer, dimension(:), allocatable subgis

  GIS code printed to output files (output.sub, .rch) (none)
- integer, dimension(:), allocatable irgage

  subbasin rain gage data code (gage # for rainfall data used in HRU) (none)
- integer, dimension(:), allocatable itgage

  subbasin temp gage data code (gage # for temperature data used in HRU) (none)
- integer, dimension(:), allocatable irelh

(none) irelh = 0 (dewpoint)
irelh = 1 (relative humidity)
note: inputs > 1.0 (dewpoint)
inputs < 1.0 (relative hum)

- integer, dimension(:), allocatable **fcst_reg**
- real ∗8, dimension(:,:), allocatable sol_aorgn

  amount of nitrogen stored in the active organic (humic) nitrogen pool in soil layer (kg N/ha)
- real ∗8, dimension(:,:), allocatable sol_fon

  amount of nitrogen stored in the fresh organic (residue) pool in soil layer (kg N/ha)
- real ∗8, dimension(:,:), allocatable sol_tmp

  average temperature of soil layer on previous day or
  daily average temperature of soil layer (deg C)
- real ∗8, dimension(:,:), allocatable sol_awc

  available water capacity of soil layer (mm H20/mm soil)
- real ∗8, dimension(:,:), allocatable volcr

  crack volume for soil layer (mm)
- real ∗8, dimension(:,:), allocatable sol_prk

  percolation storage from soil layer on current day (mm H2O)
- real ∗8, dimension(:,:), allocatable pperco_sub

  subbasin phosphorus percolation coefficient. Ratio of soluble phosphorus in surface to soluble phosphorus in percolate
- real ∗8, dimension(:,:), allocatable sol_stap

  amount of phosphorus in the soil layer stored in the stable mineral phosphorus pool (kg P/ha)
- real ∗8, dimension(:,:), allocatable conv_wt

  factor which converts kg/kg soil to kg/ha (none)
- real ∗8, dimension(:,:), allocatable sol_actp

  amount of phosphorus stored in the active mineral phosphorus pool (kg P/ha)
- real ∗8, dimension(:,:), allocatable sol_solp

  soluble P concentration in top soil layer (mg P/kg soil) or
  amount of inorganic phosphorus stored in solution in soil layer. NOTE UNIT CHANGE! (kg P/ha)
- real ∗8, dimension(:,:), allocatable crdep

  maximum or potential crack volume (mm)
- real ∗8, dimension(:,:), allocatable sol_fc

  amount of water available to plants in soil layer at field capacity (fc - wp water) (mm H2O)
- real ∗8, dimension(:,:), allocatable sol_ul

  amount of water held in the soil layer at saturation (sat - wp water) (mm H2O)
- real ∗8, dimension(:,:), allocatable sol_bd

  bulk density of the soil layer in HRU (Mg/m^3)
- real ∗8, dimension(:,:), allocatable sol_z

  depth to bottom of each soil profile layer in a given HRU (mm)
- real ∗8, dimension(:,:), allocatable sol_st

  amount of water stored in the soil layer on any given day (less wilting point water) (mm H2O)
- real ∗8, dimension(:,:), allocatable sol_up

  water content of soil at -0.033 MPa (field capacity) (mm H2O/mm soil)
- real ∗8, dimension(:,:), allocatable sol_clay

  percent clay content in soil layer in HRU (UNIT CHANGE!) (% or none)
- real ∗8, dimension(:,:), allocatable sol_hk

  beta coefficent to calculate hydraulic conductivity (none)
- real ∗8, dimension(:,:), allocatable flat

  lateral flow storage in soil layer on current day (mm H2O)
- real ∗8, dimension(:,:), allocatable sol_nh3

  amount of nitrogen stored in the ammonium pool in soil layer (kg N/ha)

- real ∗8, dimension(:,:), allocatable sol_ec

  electrical conductivity of soil layer (dS/m)
- real ∗8, dimension(:,:), allocatable sol_orgn

  amount of nitrogen stored in the stable organic N pool. NOTE UNIT CHANGE! (mg N/kg soil or kg N/ha)
- real ∗8, dimension(:,:), allocatable sol_por

  total porosity of soil layer expressed as a fraction of the total volume (none)
- real ∗8, dimension(:,:), allocatable sol_wp

  water content of soil at -1.5 MPa (wilting point) (mm H20/mm soil)
- real ∗8, dimension(:,:), allocatable sol_orgp

  amount of phosphorus stored in the organic P pool in soil layer. NOTE UNIT CHANGE! (mg P/kg soil or kg P/ha)
- real ∗8, dimension(:,:), allocatable sol_hum

  amount of organic matter in the soil layer classified as humic substances (kg humus/ha)
- real ∗8, dimension(:,:), allocatable sol_wpmm

  water content of soil at -1.5 MPa (wilting point) (mm H20)
- real ∗8, dimension(:,:), allocatable sol_no3

  amount of nitrogen stored in the nitrate pool in the soil layer. This variable is read in as a concentration and converted to kg/ha (this value is read from the .sol file in units of mg/kg) (kg N/ha)
- real ∗8, dimension(:,:), allocatable sol_cbn

  percent organic carbon in soil layer (%)
- real ∗8, dimension(:,:), allocatable sol_k

  saturated hydraulic conductivity of soil layer (mm/hour)
- real ∗8, dimension(:,:), allocatable sol_rsd

  amount of organic matter in the soil layer classified as residue (kg/ha)
- real ∗8, dimension(:,:), allocatable sol_fop

  amount of phosphorus stored in the fresh organic (residue) pool in soil layer (kg P/ha)
- real ∗8, dimension(:,:), allocatable sol_rock

  percent of rock fragments in soil layer (%)
- real ∗8, dimension(:,:), allocatable sol_silt

  percent silt content in soil material (UNIT CHANGE!) (% or none)
- real ∗8, dimension(:,:), allocatable sol_sand

  percent sand content of soil material (%)
- real ∗8, dimension(:,:), allocatable **orig_solno3**
- real ∗8, dimension(:,:), allocatable **orig_solorgn**
- real ∗8, dimension(:,:), allocatable **orig_solsolp**
- real ∗8, dimension(:,:), allocatable **orig_solorgp**
- real ∗8, dimension(:,:), allocatable **orig_soltmp**
- real ∗8, dimension(:,:), allocatable **orig_solrsd**
- real ∗8, dimension(:,:), allocatable **orig_solfop**
- real ∗8, dimension(:,:), allocatable **orig_solfon**
- real ∗8, dimension(:,:), allocatable **orig_solaorgn**
- real ∗8, dimension(:,:), allocatable **orig_solst**
- real ∗8, dimension(:,:), allocatable **orig_solactp**
- real ∗8, dimension(:,:), allocatable **orig_solstap**
- real ∗8, dimension(:,:), allocatable **orig_volcr**
- real ∗8, dimension(:,:), allocatable conk

  lateral saturated hydraulic conductivity for each profile layer in a give HRU. For example (conk(2,1) is conductivity of layer from sol_z(1,1) to sol_z(2,1) in HRU1 (mm/hr)
- real ∗8, dimension(:,:,:), allocatable sol_pst

  sol_pst(:,:,1) initial amount of pesticide in first layer read in from .chm file (mg/kg)
  sol_pst(:,:,:) amount of pesticide in soil layer. NOTE UNIT CHANGE! (kg/ha)
- real ∗8, dimension(:,:,:), allocatable sol_kp

pesticide sorption coefficient, Kp; the ratio of the concentration in the solid phase to the concentration in solution ((mg/kg)/(mg/L) or m^3/ton)

- real ∗8, dimension(:,:,:), allocatable **orig_solpst**
- real ∗8, dimension(:), allocatable **velsetlr**
- real ∗8, dimension(:), allocatable **velsetlp**
- real ∗8, dimension(:), allocatable br1

  1st shape parameter for reservoir surface area equation (none)
- real ∗8, dimension(:), allocatable evrsv

  lake evaporation coefficient (none)
- real ∗8, dimension(:), allocatable res_k

  hydraulic conductivity of the reservoir bottom (mm/hr)
- real ∗8, dimension(:), allocatable lkpst_conc

  pesticide concentration in lake water (mg/m^3)
- real ∗8, dimension(:), allocatable res_evol

  volume of water needed to fill the reservoir to the emergency spillway (read in as 10^4 m^3 and converted to m^3) (m^3)
- real ∗8, dimension(:), allocatable res_pvol

  volume of water needed to fill the reservoir to the principal spillway (read in as 10^4 m^3 and converted to m^3) (m^3)
- real ∗8, dimension(:), allocatable res_vol

  reservoir volume (read in as 10^4 m^3 and converted to m^3) (m^3)
- real ∗8, dimension(:), allocatable res_psa

  reservoir surface area when reservoir is filled to principal spillway (ha)
- real ∗8, dimension(:), allocatable lkpst_rea

  pesticide reaction coefficient in lake water (1/day)
- real ∗8, dimension(:), allocatable lkpst_vol

  pesticide volatilization coefficient in lake water (m/day)
- real ∗8, dimension(:), allocatable br2

  2nd shape parameter for reservoir surface area equation (none)
- real ∗8, dimension(:), allocatable res_rr

  average daily principal spillway release volume (read in as a release rate in m^3/s and converted to m^3/day) (m^3/day)
- real ∗8, dimension(:), allocatable res_sed

  amount of sediment in reservoir (read in as mg/L and converted to kg/L) (kg/L)
- real ∗8, dimension(:), allocatable lkpst_koc

  pesticide partition coefficient between water and sediment in lake water (m^3/g)
- real ∗8, dimension(:), allocatable lkpst_mix

  mixing velocity (diffusion/dispersion) in lake water for pesticide (m/day)
- real ∗8, dimension(:), allocatable lkpst_rsp

  resuspension velocity in lake water for pesticide sorbed to sediment (m/day)
- real ∗8, dimension(:), allocatable lkpst_stl

  settling velocity in lake water for pesticide sorbed to sediment (m/day)
- real ∗8, dimension(:), allocatable lkspst_conc

  pesticide concentration in lake bed sediment (mg/m^3)
- real ∗8, dimension(:), allocatable lkspst_rea

  pesticide reaction coefficient in lake bed sediment (1/day)
- real ∗8, dimension(:), allocatable **theta_n**
- real ∗8, dimension(:), allocatable **theta_p**
- real ∗8, dimension(:), allocatable **con_nirr**
- real ∗8, dimension(:), allocatable **con_pirr**
- real ∗8, dimension(:), allocatable lkspst_act

  depth of active sediment layer in lake for for pesticide (m)

- real *8, dimension(:), allocatable lkspst_bry

  pesticide burial velocity in lake bed sediment (m/day)
- real *8, dimension(:), allocatable **sed_stlr**
- real *8, dimension(7) **resdata**
- real *8, dimension(:), allocatable res_nsed

  normal amount of sediment in reservoir (read in as mg/L and convert to kg/L) (kg/L)
- real *8, dimension(:), allocatable wurtnf

  fraction of water removed from the reservoir via WURESN which is returned and becomes flow from the reservoir outlet (none)
- real *8, dimension(:), allocatable chlar

  chlorophyll-a production coefficient for reservoir (none)
- real *8, dimension(:), allocatable res_no3

  amount of nitrate in reservoir (kg N)
- real *8, dimension(:), allocatable res_orgn

  amount of organic N in reservoir (kg N)
- real *8, dimension(:), allocatable res_orgp

  amount of organic P in reservoir (kg P)
- real *8, dimension(:), allocatable res_solp

  amount of soluble P in reservoir (kg P)
- real *8, dimension(:), allocatable res_seci

  secchi-disk depth (m)
- real *8, dimension(:), allocatable **res_chla**
- real *8, dimension(:), allocatable res_esa

  reservoir surface area when reservoir is filled to emergency spillway (ha)
- real *8, dimension(:), allocatable res_nh3

  amount of ammonia in reservoir (kg N)
- real *8, dimension(:), allocatable res_no2

  amount of nitrite in reservoir (kg N)
- real *8, dimension(:), allocatable seccir

  water clarity coefficient for reservoir (none)
- real *8, dimension(:), allocatable **res_bactp**
- real *8, dimension(:), allocatable **res_bactlp**
- real *8, dimension(:), allocatable oflowmn_fps

  minimum reservoir outflow as a fraction of the principal spillway volume (0-1) (fraction)
- real *8, dimension(:), allocatable starg_fps

  target volume as a fraction of the principal spillway volume (.1-5) (fraction)
- real *8, dimension(:), allocatable **weirc**
- real *8, dimension(:), allocatable **weirk**
- real *8, dimension(:), allocatable **weirw**
- real *8, dimension(:), allocatable **acoef**
- real *8, dimension(:), allocatable **bcoef**
- real *8, dimension(:), allocatable **ccoef**
- real *8, dimension(:), allocatable **orig_resvol**
- real *8, dimension(:), allocatable **orig_ressed**
- real *8, dimension(:), allocatable **orig_lkpstconc**
- real *8, dimension(:), allocatable **orig_lkspstconc**
- real *8, dimension(:), allocatable **orig_ressolp**
- real *8, dimension(:), allocatable **orig_resorgp**
- real *8, dimension(:), allocatable **orig_resno3**
- real *8, dimension(:), allocatable **orig_resno2**
- real *8, dimension(:), allocatable **orig_resnh3**
- real *8, dimension(:), allocatable **orig_resorgn**

- real ∗8, dimension(:,:), allocatable oflowmn

  minimum daily ouflow for the month (read in as m^3/s and converted to m^3/day) (m^3/day)
- real ∗8, dimension(:,:), allocatable oflowmx

  maximum daily ouflow for the month (read in as m^3/s and converted to m^3/day) (m^3/day)
- real ∗8, dimension(:,:), allocatable starg

  monthly target reservoir storage (needed if IRESCO=2) (read in as 10^4 m^3 and converted to m^3) (m^3)
- real ∗8, dimension(:,:), allocatable psetlr

  psetlr(1,:) phosphorus settling rate for mid-year period (read in as m/year and converted to m/day) (m/day)
  psetlr(2,:) phosphorus settling rate for remainder of year (read in as m/year and converted to m/day) (m/day)
- real ∗8, dimension(:,:), allocatable nsetlr

  nsetlr(1,:) nitrogen settling rate for mid-year period (read in as m/year and converted to m/day) (m/day)
  nsetlr(2,:) nitrogen settling rate for remainder of year (read in as m/year and converted to m/day) (m/day)
- real ∗8, dimension(:,:), allocatable wuresn

  average amount of water withdrawn from reservoir each month for consumptive water use (read in as 10^4 m^3 and converted to m^3) (m^3)
- real ∗8, dimension(:,:,:), allocatable res_out

  measured average daily outflow from the reservoir for the month (needed if IRESCO=1) (read in as m^3/s and converted to m^3/day) (m^3/day)
- integer, dimension(:), allocatable res_sub

  number of subbasin reservoir is in (weather for the subbasin is used for the reservoir) (none)
- integer, dimension(:), allocatable ires1

  beginning of mid-year nutrient settling "season" (none)
- integer, dimension(:), allocatable ires2

  end of mid-year nutrient settling "season" (none)
- integer, dimension(:), allocatable iresco

  outflow simulation code (none):
  0 compute outflow for uncontrolled reservoir with average annual release rate
  1 measured monthly outflow
  2 simulated controlled outflow-target release
  3 measured daily outflow
  4 stage/volume/outflow relationship
- integer, dimension(:), allocatable iyres

  year of the simulation that the reservoir becomes operational (none)
- integer, dimension(:), allocatable mores

  month the reservoir becomes operational (none)
- integer, dimension(:,:), allocatable iflodr

  iflodr(1,:) beginning month of non-flood season (needed if IRESCO=2) (none)
  iflodr(2,:) ending month of non-flood season (needed if IRESCO=2) (none)
- integer, dimension(:), allocatable ndtargr

  number of days to reach target storage from current reservoir storage (needed if IRESCO=2) (days)
- real ∗8, dimension(:), allocatable ap_ef

  application efficiency (0-1) (none)
- real ∗8, dimension(:), allocatable decay_f

  exponential of the rate constant for degradation of the pesticide on foliage (none)
- real ∗8, dimension(:), allocatable skoc

  soil adsorption coefficient normalized for soil organic carbon content ((mg/kg)/(mg/L))
- real ∗8, dimension(:), allocatable decay_s

  exponential of the rate constant for degradation of the pesticide in soil (none)
- real ∗8, dimension(:), allocatable hlife_f

  half-life of pesticide on foliage (days)
- real ∗8, dimension(:), allocatable hlife_s

  half-life of pesticide in soil (days)
- real ∗8, dimension(:), allocatable pst_wof

fraction of pesticide on foliage which is washed-off by a rainfall event (none)

- real ∗8, dimension(:), allocatable pst_wsol

  solubility of chemical in water (mg/L (ppm))

- real ∗8, dimension(:), allocatable irramt

  depth of irrigation water applied to HRU (mm H2O)

- real ∗8, dimension(:), allocatable **phusw**
- real ∗8, dimension(:), allocatable **phusw_nocrop**
- integer, dimension(:), allocatable pstflg

  flag for types of pesticide used in watershed. Array location is pesticide ID number
  0: pesticide not used
  1: pesticide used

- integer, dimension(:), allocatable nope

  sequence number of pesticide in NPNO(:) (none)

- integer, dimension(:), allocatable **nop**
- integer, dimension(:), allocatable isweep

  date of street sweeping operation (julian date)

- integer, dimension(:), allocatable **yr_skip**
- integer, dimension(:), allocatable **icrmx**
- integer, dimension(:), allocatable **nopmx**
- integer, dimension(:,:), allocatable **mgtop**
- integer, dimension(:,:), allocatable **idop**
- integer, dimension(:,:), allocatable **mgt1iop**
- integer, dimension(:,:), allocatable **mgt2iop**
- integer, dimension(:,:), allocatable **mgt3iop**
- real ∗8, dimension(:,:), allocatable **mgt4op**
- real ∗8, dimension(:,:), allocatable **mgt5op**
- real ∗8, dimension(:,:), allocatable **mgt6op**
- real ∗8, dimension(:,:), allocatable **mgt7op**
- real ∗8, dimension(:,:), allocatable **mgt8op**
- real ∗8, dimension(:,:), allocatable **mgt9op**
- real ∗8, dimension(:,:), allocatable **mgt10iop**
- real ∗8, dimension(:,:), allocatable **phu_op**
- real ∗8, dimension(:), allocatable cnyld

  fraction of nitrogen in yield (kg N/kg yield)

- real ∗8, dimension(:), allocatable rsdco_pl

  plant residue decomposition coefficient. The fraction of residue which will decompose in a day assuming optimal moisture, temperature, C:N ratio, and C:P ratio (none)

- real ∗8, dimension(:), allocatable wac21

  1st shape parameter for radiation use efficiency equation (none)

- real ∗8, dimension(:), allocatable wac22

  2nd shape parameter for radiation use efficiency equation (none)

- real ∗8, dimension(:), allocatable alai_min

  minimum LAI during winter dormant period (m^2/m^2)

- real ∗8, dimension(:), allocatable leaf1

  1st shape parameter for leaf area development equation (none)

- real ∗8, dimension(:), allocatable leaf2

  2nd shape parameter for leaf area development equation (none)

- real ∗8, dimension(:), allocatable wsyf

  Value of harvest index between 0 and HVSTI which represents the lowest value expected due to water stress ((kg/ha)/(kg/ha))

- real ∗8, dimension(:), allocatable bio_e

  biomass-energy ratio. The potential (unstressed) growth rate per unit of intercepted photosynthetically active radiation ((kg/ha)/(MJ/m∗∗2))

- real ∗8, dimension(:), allocatable hvsti

  harvest index: crop yield/aboveground biomass ((kg/ha)/(kg/ha))
- real ∗8, dimension(:), allocatable t_base

  minimum temperature for plant growth (deg C)
- real ∗8, dimension(:), allocatable t_opt

  optimal temperature for plant growth (deg C)
- real ∗8, dimension(:), allocatable chtmx

  maximum canopy height (m)
- real ∗8, dimension(:), allocatable cvm

  natural log of USLE_C (the minimum value of the USLE C factor for the land cover) (none)
- real ∗8, dimension(:), allocatable gsi

  maximum stomatal conductance (m/s)
- real ∗8, dimension(:), allocatable vpd2

  rate of decline in stomatal conductance per unit increase in vapor pressure deficit ((m/s)∗(1/kPa))
- real ∗8, dimension(:), allocatable wavp

  rate of decline in radiation use efficiency as a function of vapor pressure deficit (none)
- real ∗8, dimension(:), allocatable bio_leaf

  fraction of leaf/needle biomass that drops during dormancy (for trees only) (none)
- real ∗8, dimension(:), allocatable blai

  maximum (potential) leaf area index (none)
- real ∗8, dimension(:), allocatable cpyld

  fraction of phosphorus in yield (kg P/kg yield)
- real ∗8, dimension(:), allocatable dlai

  fraction of growing season when leaf area declines (none)
- real ∗8, dimension(:), allocatable rdmx

  maximum root depth of plant (m)
- real ∗8, dimension(:), allocatable bio_n1

  1st shape parameter for plant N uptake equation (none)
- real ∗8, dimension(:), allocatable bio_n2

  2nd shape parameter for plant N uptake equation (none)
- real ∗8, dimension(:), allocatable bio_p1

  1st shape parameter for plant P uptake equation (none)
- real ∗8, dimension(:), allocatable bio_p2

  2st shape parameter for plant P uptake equation (none)
- real ∗8, dimension(:), allocatable bm_dieoff

  fraction above ground biomass that dies off at dormancy (fraction)
- real ∗8, dimension(:), allocatable **bmx_trees**
- real ∗8, dimension(:), allocatable **ext_coef**
- real ∗8, dimension(:), allocatable rsr1

  initial root to shoot ratio at the beg of growing season
- real ∗8, dimension(:), allocatable rsr2

  root to shoot ratio at the end of the growing season
- real ∗8, dimension(:), allocatable pltnfr1

  nitrogen uptake parameter #1: normal fraction of N in crop biomass at emergence (kg N/kg biomass)
- real ∗8, dimension(:), allocatable pltnfr2

  nitrogen uptake parameter #2: normal fraction of N in crop biomass at 0.5 maturity (kg N/kg biomass)
- real ∗8, dimension(:), allocatable pltnfr3

  nitrogen uptake parameter #3: normal fraction of N in crop biomass at maturity (kg N/kg biomass)
- real ∗8, dimension(:), allocatable pltpfr1

  phosphorus uptake parameter #1: normal fraction of P in crop biomass at emergence (kg P/kg biomass)

- real ∗8, dimension(:), allocatable pltpfr2

  phosphorus uptake parameter #2: normal fraction of P in crop biomass at 0.5 maturity (kg P/kg biomass)
- real ∗8, dimension(:), allocatable pltpfr3

  phosphorus uptake parameter #3: normal fraction of P in crop biomass at maturity (kg P/kg biomass)
- integer, dimension(:), allocatable idc

  crop/landcover category (none):
  1 warm season annual legume
  2 cold season annual legume
  3 perennial legume
  4 warm season annual
  5 cold season annual
  6 perennial
  7 trees
- integer, dimension(:), allocatable **mat_yrs**
- real ∗8, dimension(:), allocatable bactpdb

  concentration of persistent bacteria in manure (fertilizer) (cfu/g manure)
- real ∗8, dimension(:), allocatable fminn

  fraction of fertilize/manure that is mineral nitrogen (NO3 + NH3) (kg minN/kg fert)
- real ∗8, dimension(:), allocatable forgn

  fraction of organic nitrogen in fertilizer/manure (kg orgN/kg fert)
- real ∗8, dimension(:), allocatable forgp

  fraction of fertilizer/manure that is organic phosphorus (kg orgP/kg fert)
- real ∗8, dimension(:), allocatable bactkddb

  fraction of bacteria in solution (the remaining fraction is sorbed to soil particles) (none):
  1: all bacteria in solution
  0: all bacteria sorbed to soil particles
- real ∗8, dimension(:), allocatable bactlpdb

  concentration of less persistent bacteria in manure (fertilizer) (cfu/g manure)
- real ∗8, dimension(:), allocatable fminp

  fraction of fertilizer that is mineral phosphorus in fertilizer/manure (kg minP/kg fert)
- real ∗8, dimension(:), allocatable fnh3n

  fraction of mineral N content that is NH3-N in fertilizer/manure (kg NH3-N/kg minN)
- character(len=8), dimension(200) fertnm

  name of fertilizer
- real ∗8, dimension(:), allocatable curbden

  curb length density in HRU (km/ha)
- real ∗8, dimension(:), allocatable dirtmx

  maximum amount of solids allowed to build up on impervious surfaces (kg/curb km)
- real ∗8, dimension(:), allocatable fimp

  fraction of HRU area that is impervious (both directly and indirectly connected) (fraction)
- real ∗8, dimension(:), allocatable urbcoef

  wash-off coefficient for removal of constituents from an impervious surface (1/mm)
- real ∗8, dimension(:), allocatable thalf

  time for the amount of solids on impervious areas to build up to 1/2 the maximum level (days)
- real ∗8, dimension(:), allocatable tnconc

  concentration of total nitrogen in suspended solid load from impervious areas (mg N/kg sed)
- real ∗8, dimension(:), allocatable tno3conc

  concentration of NO3-N in suspended solid load from impervious areas (mg NO3-N/kg sed)
- real ∗8, dimension(:), allocatable tpconc

  concentration of total phosphorus in suspended solid load from impervious areas (mg P/kg sed)
- real ∗8, dimension(:), allocatable fcimp

  fraction of HRU area that is classified as directly connected impervious (fraction)
- real ∗8, dimension(:), allocatable urbcn2

SCS curve number for moisture condition II in impervious areas (none)

- real *8 fr_curb

  availability factor, the fraction of the curb length that is sweepable (none)
- real *8 frt_kg

  amount of fertilizer applied to HRU (kg/ha)
- real *8 pst_dep

  depth of pesticide in the soil (mm)
- real *8 sweepeff

  removal efficiency of sweeping operation (none)
- real *8, dimension(:), allocatable ranrns_hru

  random roughness for a given HRU (mm)
- integer, dimension(:), allocatable **itill**
- real *8, dimension(:), allocatable deptil

  depth of mixing caused by tillage operation (mm)
- real *8, dimension(:), allocatable effmix

  mixing efficiency of tillage operation (none)
- real *8, dimension(:), allocatable ranrns

  random roughness of a given tillage operation (mm)
- character(len=8), dimension(550) tillnm

  8-character name for the tillage operation
- real *8, dimension(:), allocatable rnum1s

  For ICODES equal to (none)
  0,1,3,5,9: not used
  2: fraction of overland flow in channel
  4: amount of water transferred (as defined by INUM4S)
  7,8,10,11: drainage area in square kilometers associated with the record file
  12: rearation coefficient.
- real *8, dimension(:), allocatable hyd_dakm

  total drainage area of hydrograph in square kilometers (km^2)
- real *8, dimension(:,:), allocatable shyd

  shyd(1,:) water (m^3 H2O)
  shyd(2,:) sediment or suspended solid load (metric tons)
  shyd(3,:) organic nitrogen (kg N)
  shyd(4,:) organic phosphorus (kg P)
  shyd(5,:) nitrate (kg N)
  shyd(6,:) soluble phosphorus (kg P)
  shyd(7,:) soluble pesticides (kg P)
  shyd(8,:) sorbed pesticides (kg P)
- real *8, dimension(:,:), allocatable varoute

  varoute(:,:) daily routing storage array (varies):
  varoute(1,:) temperature (deg C)
  varoute(2,:) water (m^3 H2O)
  varoute(3,:) sediment or suspended solid load (metric tons)
  varoute(4,:) organic nitrogen (kg N)
  varoute(5,:) organic phosphorus (kg P)
  varoute(6,:) nitrate (kg N)
  varoute(7,:) mineral phosphorus (kg P)
  varoute(11,:) pesticide in solution (mg pst)
  varoute(12,:) pesticide sorbed to sediment (mg pst)
  varoute(13,:) chlorophyll-a (kg)
  varoute(14,:) ammonium (kg N)
  varoute(15,:) nitrite (kg N)
  varoute(16,:) carbonaceous biological oxygen demand (kg)
  varoute(17,:) dissolved oxygen (kg)
  varoute(18,:) persistent bacteria (# cfu/100ml)
  varoute(19,:) less persistent bacteria (# cfu/100ml) varoute(20,:) conservative metal #1 (kg) varoute(21,:) conservative metal #2 (kg) varoute(22,:) conservative metal #3 (kg)

- real ∗8, dimension(:,:), allocatable **vartran**
- real ∗8, dimension(:,:,:), allocatable hhvaroute

  routing storage array for hourly time step (varies)
  hhvaroute(1,:,:) temperature (deg C)
  hhvaroute(2,:,:) water (m^3 H2O)
  hhvaroute(3,:,:) sediment or suspended solid load (metric tons)
  hhvaroute(4,:,:) organic nitrogen (kg N)
  hhvaroute(5,:,:) organic posphorus (kg P)
  hhvaroute(6,:,:) nitrate (kg N)
  hhvaroute(7,:,:) soluble mineral phosphorus (kg P)
  hhvaroute(11,:,:) pesticide in solution (mg pst)
  hhvaroute(12,:,:) pesticide sorbed to sediment (mg pst)
  hhvaroute(13,:,:) chlorophyll-a (kg)
  hhvaroute(14,:,:) ammonium (kg N)
  hhvaroute(15,:,:) nitrite (kg N)
  hhvaroute(16,:,:) carbonaceous biological oxygen demand (kg)
  hhvaroute(17,:,:) dissolved oxygen (kg O2)
  hhvaroute(18,:,:) persistent bacteria (# cfu/100ml)
  hhvaroute(19,:,:) less persistent bacteria (# cfu/100ml)
  hhvaroute(20,:,:) conservative metal #1 (kg)
  hhvaroute(21,:,:) conservative metal #2 (kg)
  hhvaroute(22,:,:) conservative metal #3 (kg)
- integer, dimension(:), allocatable icodes

  routing command code (none):
  0 = finish
  1 = subbasin
  2 = route
  3 = routres
  4 = transfer
  5 = add
  6 = rechour
  7 = recmon
  8 = recyear
  9 = save
  10 = recday
  11 = reccnst
  12 = structure
  13 = apex
  14 = saveconc
  15 =
  16 = autocal
  17 = routing unit
- integer, dimension(:), allocatable ihouts

  For ICODES equal to (none)
  0: not used
  1,2,3,5,7,8,10,11: hydrograph storage location number
  4: departure type (1=reach, 2=reservoir)
  9: hydrograph storage location of data to be printed to event file
  14:hydrograph storage location of data to be printed to saveconc file.
- integer, dimension(:), allocatable inum1s

  For ICODES equal to (none)
  0: not used
  1: subbasin number
  2: reach number
  3: reservoir number
  4: reach or res # flow is diverted from
  5: hydrograph storage location of 1st dataset to be added
  7,8,9,10,11,14: file number.
- integer, dimension(:), allocatable inum2s

  For ICODES equal to (none)
  0,1,7,8,10,11: not used

2,3: inflow hydrograph storage location
4: destination type (1=reach, 2=reservoir)
5: hydrograph storage location of 2nd dataset to be added
9,14:print frequency (0=daily, 1=hourly)

- integer, dimension(:), allocatable inum3s

  For ICODES equal to (none)
  0,1,5,7,8,10,11: not used
  2,3: subbasin number 4: destination number. Reach or reservoir receiving water
  9: print format (0=normal, fixed format; 1=txt format for AV interface, recday)

- integer, dimension(:), allocatable inum4s

  For ICODES equal to (none)
  0,2,3,5,7,8,9,10,11: not used
  1: GIS code printed to output file (optional)
  4: rule code governing transfer of water (1=fraction transferred out, 2=min volume or flow left, 3=exact amount transferred)

- integer, dimension(:), allocatable **inum5s**
- integer, dimension(:), allocatable **inum6s**
- integer, dimension(:), allocatable **inum7s**
- integer, dimension(:), allocatable **inum8s**
- integer, dimension(:), allocatable **subed**
- character(len=10), dimension(:), allocatable **recmonps**
- character(len=10), dimension(:), allocatable **reccnstps**
- character(len=5), dimension(:), allocatable **subnum**
- character(len=4), dimension(:), allocatable **hruno**
- real ∗8, dimension(:), allocatable grwat_n

  Mannings's n for grassed waterway (none)

- integer, dimension(:), allocatable grwat_i

  flag for the simulation of grass waterways (none)
  = 0 inactive
  = 1 active

- real ∗8, dimension(:), allocatable grwat_l

  length of grass waterway (km)

- real ∗8, dimension(:), allocatable grwat_w

  average width of grassed waterway (m)

- real ∗8, dimension(:), allocatable grwat_d

  depth of grassed waterway from top of bank to bottom (m)

- real ∗8, dimension(:), allocatable grwat_s

  average slope of grassed waterway channel (m)

- real ∗8, dimension(:), allocatable grwat_spcon

  linear parameter defined by user for calculating sediment transport in grassed waterways (none)

- real ∗8, dimension(:), allocatable tc_gwat

  time of concentration for grassed waterway and its drainage area (none)

- real ∗8, dimension(:), allocatable **pot_volmm**
- real ∗8, dimension(:), allocatable **pot_tilemm**
- real ∗8, dimension(:), allocatable **pot_volxmm**
- real ∗8, dimension(:), allocatable pot_fr

  fraction of HRU area that drains into pothole (km^2/km^2)

- real ∗8, dimension(:), allocatable pot_tile

  average daily outflow to main channel from tile flow if drainage tiles are installed in pothole (needed only if current HRU is IPOT) (m^3/s)

- real ∗8, dimension(:), allocatable pot_vol

  initial or current volume of water stored in the depression/impounded area (read in as mm and converted to m^3) (needed only if current HRU is IPOT) (mm or m^3 H20)

- real ∗8, dimension(:), allocatable potsa *surface area of impounded water body (ha)*

- real ∗8, dimension(:), allocatable pot_volx

  maximum volume of water stored in the depression/impounded area (read in as mm and converted to m^3) (needed only if current HRU is IPOT) (mm)
- real ∗8, dimension(:), allocatable wfsh

  wetting front matric potential (average capillary suction at wetting front) (mm)
- real ∗8, dimension(:), allocatable potflwi

  water entering pothole on day (m^3 H2O)
- real ∗8, dimension(:), allocatable potsedi

  sediment entering pothole on day (metric tons)
- real ∗8, dimension(:), allocatable pot_no3l

  nitrate decay rate in impounded area (1/day)
- real ∗8, dimension(:), allocatable pot_nsed

  normal sediment concentration in impounded water (needed only if current HRU is IPOT)(mg/L)
- real ∗8, dimension(:), allocatable gwno3

  nitrate-N concentration in groundwater loading to reach (mg N/L)
- real ∗8, dimension(:), allocatable newrti

  infiltration rate for last time step from the previous day (mm/hr)
- real ∗8, dimension(:), allocatable fsred

  reduction in bacteria loading from filter strip (none)
- real ∗8, dimension(:), allocatable pot_no3

  amount of nitrate in pothole water body (kg N)
- real ∗8, dimension(:), allocatable pot_sed

  amount of sediment in pothole water body (metric tons)
- real ∗8, dimension(:), allocatable **tmpavp**
- real ∗8, dimension(:), allocatable dis_stream

  average distance to stream (m)
- real ∗8, dimension(:), allocatable evpot

  pothole evaporation coefficient (none)
- real ∗8, dimension(:), allocatable **pot_solpl**
- real ∗8, dimension(:), allocatable **sed_con**
- real ∗8, dimension(:), allocatable **orgn_con**
- real ∗8, dimension(:), allocatable **orgp_con**
- real ∗8, dimension(:), allocatable pot_k

  hydraulic conductivity of soil surface of pothole `defaults to conductivity of upper soil (0.↩ 01-10.)  layer`
- real ∗8, dimension(:), allocatable **soln_con**
- real ∗8, dimension(:), allocatable **solp_con**
- real ∗8, dimension(:), allocatable n_reduc

  nitrogen uptake reduction factor (not currently used; defaulted 300.)
- real ∗8, dimension(:), allocatable n_lag

  lag coefficient for calculating nitrate concentration in subsurface drains (0.001 - 1.0) (dimensionless)
- real ∗8, dimension(:), allocatable n_ln

  power function exponent for calculating nitrate concentration in subsurface drains (1.0 - 3.0) (dimensionless)
- real ∗8, dimension(:), allocatable n_lnco

  coefficient for power function for calculating nitrate concentration in subsurface drains (0.5 - 4.0) (dimensionless)
- integer, dimension(:), allocatable **ioper**
- integer, dimension(:), allocatable **ngrwat**
- real ∗8, dimension(:), allocatable usle_ls

  USLE equation length slope (LS) factor (none)
- real ∗8, dimension(:), allocatable filterw

  filter strip width for bacteria transport (m)

- real ∗8, dimension(:), allocatable phuacc

  fraction of plant heat units accumulated (none)
- real ∗8, dimension(:), allocatable sumix

  sum of all tillage mixing efficiencies for HRU operation (none)
- real ∗8, dimension(:), allocatable epco

  plant water uptake compensation factor (0-1) (none)
- real ∗8, dimension(:), allocatable esco

  soil evaporation compensation factor (0-1) (none)
- real ∗8, dimension(:), allocatable hru_slp

  average slope steepness in HRU (m/m)
- real ∗8, dimension(:), allocatable slsubbsn

  average slope length for subbasin (m)
- real ∗8, dimension(:), allocatable erorgn

  organic N enrichment ratio, if left blank the model will calculate for every event (none)
- real ∗8, dimension(:), allocatable erorgp

  organic P enrichment ratio, if left blank the model will calculate for every event (none)
- real ∗8, dimension(:), allocatable biomix

  biological mixing efficiency. Mixing of soil due to activity of earthworms and other soil biota. Mixing is performed at the end of every calendar year (none)
- real ∗8, dimension(:), allocatable pnd_seci

  secchi-disk depth of pond (m)
- real ∗8, dimension(:), allocatable canmx

  maximum canopy storage (mm H2O)
- real ∗8, dimension(:), allocatable divmax

  maximum daily irrigation diversion from the reach (when IRRSC=1 or IRR=3): when value is positive the units are mm H2O; when the value is negative, the units are (10^4 m^3 H2O) (mm H2O or 10^4 m^3 H2O)
- real ∗8, dimension(:), allocatable flowmin

  minimum instream flow for irrigation diversions when IRRSC=1, irrigation water will be diverted only when streamflow is at or above FLOWMIN (m^3/s)
- real ∗8, dimension(:), allocatable usle_p

  USLE equation support practice (P) factor (none)
- real ∗8, dimension(:), allocatable lat_sed

  sediment concentration in lateral flow (g/L)
- real ∗8, dimension(:), allocatable rch_dakm

  total drainage area contributing to flow at the outlet (pour point) of the reach in square kilometers (km^2)
- real ∗8, dimension(:), allocatable cn1

  SCS runoff curve number for moisture condition I (none)
- real ∗8, dimension(:), allocatable pnd_no3s

  amount of nitrate originating from lateral flow in pond at end of day or at beginning of day(kg N)
- real ∗8, dimension(:), allocatable lat_ttime

  lateral flow travel time or exponential of the lateral flow travel time (days or none)
- real ∗8, dimension(:), allocatable cn2

  SCS runoff curve number for moisture condition II (none)
- real ∗8, dimension(:), allocatable flowfr

  fraction of available flow in reach that is allowed to be applied to the HRU (none)
- real ∗8, dimension(:), allocatable sol_zmx

  maximum rooting depth (mm)
- real ∗8, dimension(:), allocatable tile_ttime

  exponential of the tile flow travel time (none)
- real ∗8, dimension(:), allocatable slsoil

  slope length for lateral subsurface flow (m)

- real ∗8, dimension(:), allocatable gwminp

  soluble P concentration in groundwater loading to reach (mg P/L)
- real ∗8, dimension(:), allocatable sol_cov

  amount of residue on soil surface (kg/ha)
- real ∗8, dimension(:), allocatable sed_stl

  fraction of sediment remaining suspended in impoundment after settling for one day (kg/kg)
- real ∗8, dimension(:), allocatable ov_n

  Manning's "n" value for overland flow (none)
- real ∗8, dimension(:), allocatable pnd_no3

  amount of nitrate originating from surface runoff in pond at end of day or at beginning of day (kg N)
- real ∗8, dimension(:), allocatable pnd_solp

  amount of soluble P originating from surface runoff in pond at end of day or at beginning of day (kg P)
- real ∗8, dimension(:), allocatable yldanu

  annual yield (dry weight) in the HRU (metric tons/ha)
- real ∗8, dimension(:), allocatable driftco

  coefficient for pesticide drift directly onto stream (none)
- real ∗8, dimension(:), allocatable pnd_orgn

  amount of organic N originating from surface runoff in pond at end of day or at beginning of day (kg N)
- real ∗8, dimension(:), allocatable pnd_orgp

  amount of organic P originating from surface runoff in pond at end of day or at beginning of day (kg P)
- real ∗8, dimension(:), allocatable cn3

  SCS runoff curve number for moisture condition III (none)
- real ∗8, dimension(:), allocatable twlpnd

  water lost through seepage from ponds on day in HRU (mm H2O)
- real ∗8, dimension(:), allocatable twlwet

  water lost through seepage from wetlands on day in HRU (mm H2O)
- real ∗8, dimension(:), allocatable hru_fr

  fraction of subbasin area contained in HRU (km^2/km^2)
- real ∗8, dimension(:), allocatable sol_sumul

  amount of water held in soil profile at saturation (mm H2O)
- real ∗8, dimension(:), allocatable pnd_chla

  amount of chlorophyll-a in pond at end of day (kg chl_a)
- real ∗8, dimension(:), allocatable hru_km

  area of HRU in square kilometers (km^2)
- real ∗8, dimension(:), allocatable bio_ms

  land cover/crop biomass (dry weight) (kg/ha)
- real ∗8, dimension(:), allocatable sol_alb

  albedo when soil is moist (none)
- real ∗8, dimension(:), allocatable strsw

  fraction of potential plant growth achieved on the day where the reduction is caused by water stress (none)
- real ∗8, dimension(:), allocatable pnd_fr

  fraction of HRU/subbasin area that drains into ponds (none)
- real ∗8, dimension(:), allocatable pnd_k

  hydraulic conductivity through bottom of ponds (mm/hr)
- real ∗8, dimension(:), allocatable pnd_psa

  surface area of ponds when filled to principal spillway (ha)
- real ∗8, dimension(:), allocatable pnd_pvol

  runoff volume of water from catchment area needed to fill the ponds to the principal spillway (UNIT CHANGE!) (10^4 m^3 H2O or m^3 H2O)
- real ∗8, dimension(:), allocatable pnd_esa

  surface area of ponds when filled to emergency spillway (ha)

- real ∗8, dimension(:), allocatable pnd_evol

  runoff volume of water from catchment area needed to fill the ponds to the emergency spillway (UNIT CHANGE!) (10^ 4 m^ 3 H2O or m^ 3 H2O)
- real ∗8, dimension(:), allocatable pnd_vol

  volume of water in ponds (UNIT CHANGE!) (10^ 4 m^ 3 H2O or m^ 3 H2O)
- real ∗8, dimension(:), allocatable yldaa

  average annual yield (dry weight) in the HRU (metric tons)
- real ∗8, dimension(:), allocatable pnd_nsed

  normal sediment concentration in pond water (UNIT CHANGE!) (mg/kg or kg/kg)
- real ∗8, dimension(:), allocatable pnd_sed

  sediment concentration in pond water (UNIT CHANGE!) (mg/kg or kg/kg)
- real ∗8, dimension(:), allocatable dep_imp

  depth to impervious layer (mm)
- real ∗8, dimension(:), allocatable **strsa**
- real ∗8, dimension(:), allocatable **evpnd**
- real ∗8, dimension(:), allocatable **evwet**
- real ∗8, dimension(:), allocatable wet_fr

  fraction of HRU/subbasin area that drains into wetlands (none)
- real ∗8, dimension(:), allocatable wet_k

  hydraulic conductivity of bottom of wetlands (mm/hr)
- real ∗8, dimension(:), allocatable wet_nsa

  surface area of wetlands in subbasin at normal water level (ha)
- real ∗8, dimension(:), allocatable wet_nvol

  runoff volume of water from catchment area needed to fill wetlands to normal water level (UNIT CHANGE!) (10^ 4 m^ 3 H2O or m^ 3 H2O)
- integer, dimension(:), allocatable **iwetgw**
- integer, dimension(:), allocatable **iwetile**
- real ∗8, dimension(:), allocatable wet_mxsa

  surface area of wetlands at maximum water level (ha)
- real ∗8, dimension(:), allocatable wet_mxvol

  runoff volume of water from catchment area needed to fill wetlands to maximum water level (UNIT CHANGE!) (10^ 4 m^ 3 H2O or m^ 3 H2O)
- real ∗8, dimension(:), allocatable wet_vol

  volume of water in wetlands (UNIT CHANGE!) (10^ 4 m^ 3 H2O or m^ 3 H2O)
- real ∗8, dimension(:), allocatable wet_nsed

  normal sediment concentration in wetland water (UNIT CHANGE!) (mg/kg or kg/kg)
- real ∗8, dimension(:), allocatable wet_sed

  sediment concentration in wetland water (UNIT CHANGE!) (mg/L or kg/L)
- real ∗8, dimension(:,:), allocatable bp

  bp(1,:) 1st shape parameter for the pond surface area equation (none)
  bp(2,:) 2nd shape parameter for the pond surface area equation (none)
- real ∗8, dimension(:), allocatable sci

  retention coefficient for CN method based on plant ET (none)
- real ∗8, dimension(:), allocatable smx

  retention coefficient for CN method based on soil moisture (none)
- real ∗8, dimension(:,:), allocatable bw

  bw(1,:) 1st shape parameter for the wetland surface area equation (none)
  bw(2,:) 2nd shape parameter for the wetland surface area equation (none)
- real ∗8, dimension(:), allocatable bactpq

  persistent bacteria in soil solution (# cfu/m^ 2)
- real ∗8, dimension(:), allocatable cnday

  curve number for current day, HRU and at current soil moisture (none)

- real ∗8, dimension(:), allocatable bactlp_plt

  less persistent bacteria on foliage (# cfu/m^2)
- real ∗8, dimension(:), allocatable bactp_plt

  persistent bacteria on foliage (# cfu/m^2)
- real ∗8, dimension(:), allocatable auto_eff

  fertilizer application efficiency calculated as the amount of N applied divided by the amount of N removed at harvest (none)
- real ∗8, dimension(:), allocatable secciw

  water clarity coefficient for wetland (none)
- real ∗8, dimension(:), allocatable sol_sw

  amount of water stored in soil profile at end of any given day (mm H2O)
- real ∗8, dimension(:), allocatable bactlpq

  less persistent bacteria in soil solution (# cfu/m^2)
- real ∗8, dimension(:), allocatable chlaw

  chlorophyll-a production coefficient for wetland (none)
- real ∗8, dimension(:), allocatable tmpav

  average air temperature on current day in HRU (deg C)
- real ∗8, dimension(:), allocatable bactlps

  less persistent bacteria attached to soil particles (# cfu/m^2)
- real ∗8, dimension(:), allocatable bactps

  persistent bacteria attached to soil particles (# cfu/m^2)
- real ∗8, dimension(:), allocatable sno_hru

  amount of water stored as snow in HRU on current day (mm H2O)
- real ∗8, dimension(:), allocatable wet_orgn

  amount of organic N originating from surface runoff in wetland at end of day (kg N)
- real ∗8, dimension(:), allocatable hru_ra

  solar radiation for the day in HRU (MJ/m^2)
- real ∗8, dimension(:), allocatable subp

  precipitation for the day in HRU (mm H2O)
- real ∗8, dimension(:), allocatable rsdin

  initial residue cover (kg/ha)
- real ∗8, dimension(:), allocatable tmn

  minimum air temperature on current day in HRU (deg C)
- real ∗8, dimension(:), allocatable tmx

  maximum air temperature on current day in HRU (deg C)
- real ∗8, dimension(:), allocatable tmp_hi

  last maximum temperature in HRU (deg C)
- real ∗8, dimension(:), allocatable tmp_lo

  last minimum temperature in HRU (deg C)
- real ∗8, dimension(:), allocatable usle_k

  USLE equation soil erodibility (K) factor (none)
- real ∗8, dimension(:), allocatable tconc

  time of concentration for HRU (hour)
- real ∗8, dimension(:), allocatable hru_rmx

  maximum possible solar radiation for the day in HRU (MJ/m^2)
- real ∗8, dimension(:), allocatable rwt

  fraction of total plant biomass that is in roots (none)
- real ∗8, dimension(:), allocatable **olai**
- real ∗8, dimension(:), allocatable **usle_cfac**
- real ∗8, dimension(:), allocatable **usle_eifac**
- real ∗8, dimension(:), allocatable sol_sumfc

amount of water held in soil profile at field capacity (mm H2O)

- real ∗8, dimension(:), allocatable t_ov

  time for flow from farthest point in subbasin to enter a channel (hour)
- real ∗8, dimension(:), allocatable anano3

  total amount of NO3 applied during the year in auto-fertilization (kg N/ha)
- real ∗8, dimension(:), allocatable aird

  amount of water applied to HRU on current day (mm H2O)
- real ∗8, dimension(:), allocatable wet_orgp

  amount of organic P originating from surface runoff in wetland at end of day (kg P)
- real ∗8, dimension(:), allocatable sol_avpor

  average porosity for entire soil profile (none)
- real ∗8, dimension(:), allocatable usle_mult

  product of USLE K,P,LS,exp(rock) (none)
- real ∗8, dimension(:), allocatable rhd

  relative humidity for the day in HRU (none)
- real ∗8, dimension(:), allocatable u10

  wind speed (measured at 10 meters above surface) for the day in HRU (m/s)
- real ∗8, dimension(:), allocatable cht

  canopy height (m)
- real ∗8, dimension(:), allocatable aairr

  average annual amount of irrigation water applied to HRU (mm H2O)
- real ∗8, dimension(:), allocatable lai_aamx

  maximum leaf area index for the entire period of simulation in the HRU (none)
- real ∗8, dimension(:), allocatable deepirr

  amount of water removed from deep aquifer for irrigation (mm H2O)
- real ∗8, dimension(:), allocatable shallirr

  amount of water removed from shallow aquifer for irrigation (mm H2O)
- real ∗8, dimension(:), allocatable wet_no3

  amount of nitrate originating from surface runoff in wetland at end of day (kg N)
- real ∗8, dimension(:), allocatable ovrlnd

  overland flow onto HRU from upstream routing unit (mm H2O)
- real ∗8, dimension(:), allocatable canstor

  amount of water held in canopy storage (mm H2O)
- real ∗8, dimension(:), allocatable irr_mx

  maximum irrigation amount per auto application (mm)
- real ∗8, dimension(:), allocatable auto_wstr

  water stress factor which triggers auto irrigation (none or mm)
- real ∗8, dimension(:), allocatable cfrt_id

  fertilizer/manure identification number from database (fert.dat) (none)
- real ∗8, dimension(:), allocatable cfrt_kg

  amount of fertilzier/manure applied to HRU on a given day ((kg/ha)/day)
- real ∗8, dimension(:), allocatable **cpst_id**
- real ∗8, dimension(:), allocatable **cpst_kg**
- real ∗8, dimension(:), allocatable irr_asq

  surface runoff ratio
- real ∗8, dimension(:), allocatable **irr_eff**
- real ∗8, dimension(:), allocatable irrsq

  surface runoff ratio (0-1) .1 is 10% surface runoff (frac)
- real ∗8, dimension(:), allocatable irrsalt

  concentration of salt in irrigation water (mg/kg)
- real ∗8, dimension(:), allocatable **irrefm**

- real ∗8, dimension(:), allocatable bio_eat

  dry weight of biomass removed by grazing daily ((kg/ha)/day)
- real ∗8, dimension(:), allocatable bio_trmp

  dry weight of biomass removed by trampling daily ((kg/ha)/day)
- integer, dimension(:), allocatable ipst_freq

  number of days between applications (days)
- integer, dimension(:), allocatable ifrt_freq

  number of days between applications in continuous fertlizer operation (days)
- integer, dimension(:), allocatable **irr_noa**
- integer, dimension(:), allocatable **irr_sc**
- integer, dimension(:), allocatable **irr_no**
- integer, dimension(:), allocatable imp_trig

  release/impound action code (none):
  0 begin impounding water
  1 release impounded water
- integer, dimension(:), allocatable fert_days

  number of days continuous fertilization will be simulated (none)
- integer, dimension(:), allocatable **irr_sca**
- integer, dimension(:), allocatable idplt

  land cover/crop identification code for first crop grown in HRU (the only crop if there is no rotation) (from crop.dat) (none)
- integer, dimension(:), allocatable wstrs_id

  water stress identifier (none):
  1 plant water demand
  2 soil water deficit
- integer, dimension(:), allocatable **pest_days**
- real ∗8, dimension(:,:), allocatable **bio_aahv**
- real ∗8, dimension(:), allocatable **cumei**
- real ∗8, dimension(:), allocatable **cumeira**
- real ∗8, dimension(:), allocatable **cumrt**
- real ∗8, dimension(:), allocatable **cumrai**
- real ∗8, dimension(:), allocatable wet_solp

  amount of soluble P originating from surface runoff in wetland at end of day (kg P)
- real ∗8, dimension(:), allocatable wet_chla

  amount of chlorophyll-a in wetland at end of day (kg chla)
- real ∗8, dimension(:), allocatable wet_no3s

  amount of nitrate originating from lateral flow in wetland at end of day (kg N)
- real ∗8, dimension(:), allocatable pstsol

  amount of soluble pesticide leached from bottom of soil profile on current day (kg pst/ha)
- real ∗8, dimension(:), allocatable pnd_no3g

  amount of nitrate originating from groundwater in pond at end of day or at beginning of day (kg N)
- real ∗8, dimension(:), allocatable wet_seci

  secchi-disk depth in wetland at end of day (m)
- real ∗8, dimension(:), allocatable delay

  groundwater delay: time required for water leaving the bottom of the root zone to reach the shallow aquifer (days)
- real ∗8, dimension(:), allocatable gwht

  groundwater height (m)
- real ∗8, dimension(:), allocatable gw_q

  groundwater contribution to streamflow from HRU on current day (mm H2O)
- real ∗8, dimension(:), allocatable pnd_solpg

  amount of soluble P originating from groundwater in pond at end of day or at beginning of day (kg P)
- real ∗8, dimension(:), allocatable alpha_bf

alpha factor for groundwater recession curve (1/days)

- real *8, dimension(:), allocatable alpha_bfe

  $\exp(-alpha_b f)$ *(none)*

- real *8, dimension(:), allocatable gw_spyld

  specific yield for shallow aquifer (m^3/m^3)

- real *8, dimension(:), allocatable alpha_bf_d

  alpha factor for groudwater recession curve of the deep aquifer (1/days)

- real *8, dimension(:), allocatable alpha_bfe_d

  $\exp(-alpha_b f_d)$ *for deep aquifer (none)*

- real *8, dimension(:), allocatable gw_qdeep

  groundwater contribution to streamflow from deep aquifer from HRU on current day (mm H2O)

- real *8, dimension(:), allocatable gw_delaye

  $\exp(-1/delay)$ *where delay(:) is the groundwater delay (time required for water leaving the bottom of the root zone to reach the shallow aquifer; units-days) (none)*

- real *8, dimension(:), allocatable gw_revap

  revap coeff: this variable controls the amount of water moving from the shallow aquifer to the root zone as a result of soil moisture depletion (none)

- real *8, dimension(:), allocatable rchrg_dp

  recharge to deep aquifer: the fraction of root zone percolation that reaches the deep aquifer (none)

- real *8, dimension(:), allocatable anion_excl

  fraction of porosity from which anions are excluded

- real *8, dimension(:), allocatable revapmn

  threshold depth of water in shallow aquifer required to allow revap to occur (mm H2O)

- real *8, dimension(:), allocatable rchrg

  amount of water recharging both aquifers on current day in HRU (mm H2O)

- real *8, dimension(:), allocatable bio_min

  minimum plant biomass for grazing (kg/ha)

- real *8, dimension(:), allocatable ffc

  initial HRU soil water content expressed as fraction of field capacity (none)

- real *8, dimension(:), allocatable surqsolp

  amount of soluble phosphorus in surface runoff in HRU for the day (kg P/ha)

- real *8, dimension(:), allocatable deepst

  depth of water in deep aquifer (mm H2O)

- real *8, dimension(:), allocatable shallst

  depth of water in shallow aquifer in HRU (mm H2O)

- real *8, dimension(:), allocatable wet_solpg

  amount of soluble P originating from groundwater in wetland at end of day (kg P)

- real *8, dimension(:), allocatable **cklsp**
- real *8, dimension(:), allocatable **rchrg_src**
- real *8, dimension(:), allocatable trapeff

  filter strip trapping efficiency (used for everything but bacteria) (none)

- real *8, dimension(:), allocatable sol_avbd

  average bulk density for soil profile (Mg/m^3)

- real *8, dimension(:), allocatable wet_no3g

  amount of nitrate originating from groundwater in wetland at end of day (kg N)

- real *8, dimension(:), allocatable tdrain

  time to drain soil to field capacity yield used in autofertilization (hours)

- real *8, dimension(:), allocatable gwqmn

  threshold depth of water in shallow aquifer required before groundwater flow will occur (mm H2O)

- real *8, dimension(:), allocatable snotmp

  temperature of snow pack in HRU (deg C)

- real ∗8, dimension(:), allocatable pplnt

  plant uptake of phosphorus in HRU for the day (kg P/ha)
- real ∗8, dimension(:), allocatable gdrain

  drain tile lag time: the amount of time between the transfer of water from the soil to the drain tile and the release of the water from the drain tile to the reach (hours)
- real ∗8, dimension(:), allocatable ddrain

  depth of drain tube from the soil surface (mm)
- real ∗8, dimension(:), allocatable sol_crk

  crack volume potential of soil (none)
- real ∗8, dimension(:), allocatable brt

  fraction of surface runoff within the subbasin which takes 1 day or less to reach the subbasin outlet (none)
- real ∗8, dimension(:), allocatable dayl

  length of the current day (hours)
- real ∗8, dimension(:), allocatable sstmaxd

  static maximum depressional storage; read from .sdr (mm)
- real ∗8, dimension(:), allocatable re

  effective radius of drains (mm)
- real ∗8, dimension(:), allocatable sdrain

  distance between two drain tubes or tiles (mm)
- real ∗8, dimension(:), allocatable **ddrain_hru**
- real ∗8, dimension(:), allocatable drain_co

  drainage coefficient (mm/day)
- real ∗8, dimension(:), allocatable latksatf

  multiplication factor to determine conk(j1,j) from sol_k(j1,j) for HRU (none)
- real ∗8, dimension(:), allocatable pc

  pump capacity (default pump capacity = 1.042mm/hr or 25mm/day) (mm/hr)
- real ∗8, dimension(:), allocatable stmaxd

  maximum surface depressional storage for day in a given HRU (mm)
- real ∗8, dimension(:), allocatable rnd3

  random number between 0.0 and 1.0 (none)
- real ∗8, dimension(:), allocatable rnd2

  random number between 0.0 and 1.0 (none)
- real ∗8, dimension(:), allocatable twash

  time that solids have built-up on streets (days)
- real ∗8, dimension(:), allocatable doxq

  dissolved oxygen concentration in the surface runoff on current day in HRU (mg/L)
- real ∗8, dimension(:), allocatable sol_cnsw

  soil water content used to calculate daily CN value (initial soil water content for day) (mm H2O)
- real ∗8, dimension(:), allocatable rnd8

  random number between 0.0 and 1.0 (none)
- real ∗8, dimension(:), allocatable rnd9

  random number between 0.0 and 1.0 (none)
- real ∗8, dimension(:), allocatable percn

  amount of nitrate percolating past bottom of soil profile during the day (kg N/ha)
- real ∗8, dimension(:), allocatable **sol_sumwp**
- real ∗8, dimension(:), allocatable qdr

  total or net amount of water entering main channel for day from HRU (mm H2O)
- real ∗8, dimension(:), allocatable tauton

  amount of N applied in autofert operation in year (kg N/ha)
- real ∗8, dimension(:), allocatable tautop

  amount of P applied in autofert operation in year (kg N/ha)

- real ∗8, dimension(:), allocatable cbodu

  carbonaceous biological oxygen demand of surface runoff on current day in HRU (mg/L)
- real ∗8, dimension(:), allocatable chl_a

  chlorophyll-a concentration in water yield on current day in HRU (microgram/L)
- real ∗8, dimension(:), allocatable **tfertn**
- real ∗8, dimension(:), allocatable **tfertp**
- real ∗8, dimension(:), allocatable **tgrazn**
- real ∗8, dimension(:), allocatable **tgrazp**
- real ∗8, dimension(:), allocatable latq

  total amount of water in lateral flow in soil profile for the day in HRU (mm H2O)
- real ∗8, dimension(:), allocatable nplnt

  plant uptake of nitrogen in HRU for the day (kg N/ha)
- real ∗8, dimension(:), allocatable latno3

  amount of nitrate transported with lateral flow in HRU for the day (kg N/ha)
- real ∗8, dimension(:), allocatable minpgw

  soluble P loading to reach in groundwater (kg P/ha)
- real ∗8, dimension(:), allocatable no3gw

  nitrate loading to reach in groundwater (kg N/ha)
- real ∗8, dimension(:), allocatable **tileq**
- real ∗8, dimension(:), allocatable **tileno3**
- real ∗8, dimension(:), allocatable sedorgn

  amount of organic nitrogen in surface runoff in HRU for the day (kg N/ha)
- real ∗8, dimension(:), allocatable sedminpa

  amount of active mineral phosphorus sorbed to sediment in surface runoff in HRU for day (kg P/ha)
- real ∗8, dimension(:), allocatable sedminps

  amount of stable mineral phosphorus sorbed to sediment in surface runoff in HRU for day (kg P/ha)
- real ∗8, dimension(:), allocatable sedyld

  soil loss caused by water erosion for day in HRU (metric tons)
- real ∗8, dimension(:), allocatable sepbtm

  percolation from bottom of soil profile for the day in HRU (mm H2O)
- real ∗8, dimension(:), allocatable strsn

  fraction of potential plant growth achieved on the day where the reduction is caused by nitrogen stress (none)
- real ∗8, dimension(:), allocatable sedorgp

  amount of organic phosphorus in surface runoff in HRU for the day (kg P/ha)
- real ∗8, dimension(:), allocatable surfq

  surface runoff generated in HRU on the current day (mm H2O)
- real ∗8, dimension(:), allocatable strstmp

  fraction of potential plant growth achieved on the day in HRU where the reduction is caused by temperature stress (none)
- real ∗8, dimension(:), allocatable strsp

  fraction of potential plant growth achieved on the day where the reduction is caused by phosphorus stress (none)
- real ∗8, dimension(:), allocatable surqno3

  amount of nitrate transported in surface runoff in HRU for the day (kg N/ha)
- real ∗8, dimension(:), allocatable hru_ha

  area of HRU in hectares (ha)
- real ∗8, dimension(:), allocatable hru_dafr

  fraction of total watershed area contained in HRU (km2/km2)
- real ∗8, dimension(:), allocatable **tcfrtn**
- real ∗8, dimension(:), allocatable **tcfrtp**
- real ∗8, dimension(:), allocatable drydep_no3

  atmospheric dry deposition of nitrates (kg/ha/yr)

- real ∗8, dimension(:), allocatable drydep_nh4

  atmospheric dry deposition of ammonia (kg/ha/yr)
- real ∗8, dimension(:), allocatable bio_yrms

  annual biomass (dry weight) in the HRU (metric tons/ha)
- real ∗8, dimension(:), allocatable phubase

  base zero total heat units (used when no land cover is growing) (heat units)
- real ∗8, dimension(:), allocatable hvstiadj

  optimal harvest index adjusted for water stress for current time during growing season ((kg/ha)/(kg/ha))
- real ∗8, dimension(:), allocatable laiday

  leaf area index for HRU (m^2/m^2)
- real ∗8, dimension(:), allocatable chlap

  chlorophyll-a production coefficient for pond (none)
- real ∗8, dimension(:), allocatable pnd_psed

  amount of mineral P attached to sediment originating from surface runoff in pond at end of day or beginnig of day (kg P)
- real ∗8, dimension(:), allocatable **laimxfr**
- real ∗8, dimension(:), allocatable seccip

  water clarity coefficient for pond (none)
- real ∗8, dimension(:), allocatable plantn

  amount of nitrogen in plant biomass (kg N/ha)
- real ∗8, dimension(:), allocatable plt_et

  actual ET simulated during life of plant (mm H2O)
- real ∗8, dimension(:), allocatable wet_psed

  amount of mineral P attached to sediment originating from surface runoff in wetland at end of day (kg P)
- real ∗8, dimension(:), allocatable bio_aams

  average annual biomass (dry weight) in the HRU (metric tons)
- real ∗8, dimension(:), allocatable plantp

  amount of phosphorus stored in plant biomass (kg P/ha)
- real ∗8, dimension(:), allocatable plt_pet

  potential ET simulated during life of plant (mm H2O)
- real ∗8, dimension(:), allocatable dormhr

  time threshold used to define dormant period for plant (when daylength is within the time specified by dl from the minimum daylength for the area, the plant will go dormant) (hour)
- real ∗8, dimension(:), allocatable lai_yrmx

  maximum leaf area index for the year in the HRU (none)
- real ∗8, dimension(:), allocatable **bio_aamx**
- real ∗8, dimension(:), allocatable lat_pst

  amount of pesticide in lateral flow in HRU for the day (kg pst/ha)
- real ∗8, dimension(:), allocatable fld_fr

  fraction of HRU area that drains into floodplain (km^2/km^2)
- real ∗8, dimension(:), allocatable **orig_snohru**
- real ∗8, dimension(:), allocatable **orig_potvol**
- real ∗8, dimension(:), allocatable pltfr_n

  fraction of plant biomass that is nitrogen (none)
- real ∗8, dimension(:), allocatable **orig_alai**
- real ∗8, dimension(:), allocatable **orig_bioms**
- real ∗8, dimension(:), allocatable pltfr_p

  fraction of plant biomass that is phosphorus (none)
- real ∗8, dimension(:), allocatable **orig_phuacc**
- real ∗8, dimension(:), allocatable **orig_sumix**
- real ∗8, dimension(:), allocatable phu_plt

  total number of heat units to bring plant to maturity (heat units)

- real ∗8, dimension(:), allocatable **orig_phu**
- real ∗8, dimension(:), allocatable **orig_shallst**
- real ∗8, dimension(:), allocatable **orig_deepst**
- real ∗8, dimension(:), allocatable rip_fr

  fraction of HRU area that drains into riparian zone (km^2/km^2)
- real ∗8, dimension(:), allocatable **orig_pndvol**
- real ∗8, dimension(:), allocatable **orig_pndsed**
- real ∗8, dimension(:), allocatable **orig_pndno3**
- real ∗8, dimension(:), allocatable **orig_pndsolp**
- real ∗8, dimension(:), allocatable **orig_pndorgn**
- real ∗8, dimension(:), allocatable **orig_pndorgp**
- real ∗8, dimension(:), allocatable **orig_wetvol**
- real ∗8, dimension(:), allocatable **orig_wetsed**
- real ∗8, dimension(:), allocatable **orig_wetno3**
- real ∗8, dimension(:), allocatable **orig_wetsolp**
- real ∗8, dimension(:), allocatable **orig_wetorgn**
- real ∗8, dimension(:), allocatable **orig_wetorgp**
- real ∗8, dimension(:), allocatable **orig_solcov**
- real ∗8, dimension(:), allocatable **orig_solsw**
- real ∗8, dimension(:), allocatable **orig_potno3**
- real ∗8, dimension(:), allocatable **orig_potsed**
- real ∗8, dimension(:), allocatable wtab

  water table based on 30 day antecedent climate (precip,et) (mm)
- real ∗8, dimension(:), allocatable **wtab_mn**
- real ∗8, dimension(:), allocatable **wtab_mx**
- real ∗8, dimension(:), allocatable shallst_n

  nitrate concentration in shallow aquifer converted to kg/ha (ppm NO3-N)
- real ∗8, dimension(:), allocatable **gw_nloss**
- real ∗8, dimension(:), allocatable **rchrg_n**
- real ∗8, dimension(:), allocatable **det_san**
- real ∗8, dimension(:), allocatable **det_sil**
- real ∗8, dimension(:), allocatable **det_cla**
- real ∗8, dimension(:), allocatable **det_sag**
- real ∗8, dimension(:), allocatable **det_lag**
- real ∗8, dimension(:), allocatable afrt_surface

  fraction of fertilizer which is applied to top 10 mm of soil (the remaining fraction is applied to first soil layer) (none)
- real ∗8, dimension(:), allocatable tnylda

  estimated/target nitrogen content of yield used in autofertilization (kg N/kg yield)
- real ∗8 frt_surface

  fraction of fertilizer which is applied to the top 10 mm of soil (the remaining fraction is applied to the first soil layer) (none)
- real ∗8, dimension(:), allocatable auto_nyr

  maximum NO3-N content allowed to be applied in one year by auto-fertilization (kg NO3-N/ha)
- real ∗8, dimension(:), allocatable auto_napp

  maximum NO3-N content allowed in one fertilizer application (kg NO3-N/ha)
- real ∗8, dimension(:), allocatable auto_nstrs

  nitrogen stress factor which triggers auto fertilization (none)
- real ∗8, dimension(:), allocatable manure_kg

  dry weight of manure deposited on HRU daily ((kg/ha)/day)
- real ∗8, dimension(:,:), allocatable **rcn_mo**
- real ∗8, dimension(:,:), allocatable **rammo_mo**
- real ∗8, dimension(:,:), allocatable **drydep_no3_mo**
- real ∗8, dimension(:,:), allocatable **drydep_nh4_mo**

- real ∗8, dimension(:), allocatable **rcn_d**
- real ∗8, dimension(:), allocatable **rammo_d**
- real ∗8, dimension(:), allocatable **drydep_no3_d**
- real ∗8, dimension(:), allocatable **drydep_nh4_d**
- real ∗8, dimension(:,:), allocatable **yldn**
- integer, dimension(:,:), allocatable **gwati**
- real ∗8, dimension(:,:), allocatable **gwatn**
- real ∗8, dimension(:,:), allocatable **gwatl**
- real ∗8, dimension(:,:), allocatable **gwatw**
- real ∗8, dimension(:,:), allocatable **gwatd**
- real ∗8, dimension(:,:), allocatable **gwatveg**
- real ∗8, dimension(:,:), allocatable **gwata**
- real ∗8, dimension(:,:), allocatable **gwats**
- real ∗8, dimension(:,:), allocatable **gwatspcon**
- real ∗8, dimension(:,:), allocatable **rfqeo_30d**
- real ∗8, dimension(:,:), allocatable **eo_30d**
- real ∗8, dimension(:,:), allocatable psetlp

  psetlp(1,:) phosphorus settling rate for 1st season (m/day)
  psetlp(2,:) phosphorus settling rate for 2nd season (m/day)
- real ∗8, dimension(:,:), allocatable wgnold

  previous value of wgncur(:,:) (none)
- real ∗8, dimension(:,:), allocatable wgncur

  parameter to predict the impact of precip on other weather attributes (none)
  wgncur(1,:) parameter which predicts impact of precip on daily maximum air temperature
  wgncur(2,:) parameter which predicts impact of precip on daily minimum air temperature
  wgncur(3,:) parameter which predicts impact of precip on daily solar radiation
- real ∗8, dimension(:), allocatable wrt1

  1st shape parameter for calculation of water retention (none)
- real ∗8, dimension(:), allocatable wrt2

  2nd shape parameter for calculation of water retention (none)
- real ∗8, dimension(:,:), allocatable pst_enr

  pesticide enrichment ratio (none)
- real ∗8, dimension(:,:), allocatable pst_surq

  amount of pesticide type lost in surface runoff on current day in HRU (kg/ha)
- real ∗8, dimension(:,:), allocatable zdb

  division term from net pesticide equation (mm)
- real ∗8, dimension(:,:), allocatable plt_pst

  pesticide on plant foliage (kg/ha)
- real ∗8, dimension(:,:), allocatable psetlw

  psetlw(1,:) phosphorus settling rate for 1st season (m/day)
  psetlw(2,:) phosphorus settling rate for 2nd season (m/day)
- real ∗8, dimension(:,:), allocatable pst_sed

  pesticide loading from HRU sorbed onto sediment (kg/ha)
- real ∗8, dimension(:,:), allocatable wupnd

  average daily water removal from the pond for the month for the HRU within the subbasin (10^4 m^3/day)
- real ∗8, dimension(:,:), allocatable phi

  phi(1,:) cross-sectional area of flow at bankfull depth (m^2) phi(2,:) (none) phi(3,:) (none) phi(4,:) (none) phi(5,:) flow rate when reach is at bankfull depth (m^3/s) phi(6,:) bottom width of main channel (m) phi(7,:) depth of water when reach is at bankfull depth (m) phi(8,:) average velocity when reach is at bankfull depth (m/s) phi(9,:) wave celerity when reach is at bankfull depth (m/s) phi(10,:) storage time constant for reach at bankfull depth (ratio of storage to discharge) (hour) phi(11,:) average velocity when reach is at 0.1 bankfull depth (low flow) (m/s) phi(12,:) wave celerity when reach is at 0.1 bankfull depth (low flow) (m/s) phi(13,:) storage time constant for reach at 0.1 bankfull depth (low flow) (ratio of storage to discharge) (hour)
- real ∗8, dimension(:,:), allocatable pcpband

precipitation for the day in band in HRU (mm H2O)

- real ∗8, dimension(:,:), allocatable tavband

  average temperature for the day in band in HRU (deg C)
- real ∗8, dimension(:), allocatable wat_phi1

  cross-sectional area of flow at bankfull depth (m^2)
- real ∗8, dimension(:), allocatable wat_phi5

  flow rate when reach is at bankfull depth (m^3/s)
- real ∗8, dimension(:), allocatable wat_phi6

  bottom width of main channel (m)
- real ∗8, dimension(:), allocatable wat_phi7

  depth of water when reach is at bankfull depth (m)
- real ∗8, dimension(:), allocatable wat_phi8

  average velocity when reach is at bankfull depth (m/s)
- real ∗8, dimension(:), allocatable wat_phi9

  wave celerity when reach is at bankfull depth (m/s)
- real ∗8, dimension(:), allocatable wat_phi10

  storage time constant for reach at bankfull depth (ratio of storage to discharge) (hour)
- real ∗8, dimension(:), allocatable wat_phi11

  average velocity when reach is at 0.1 bankfull depth (low flow) (m/s)
- real ∗8, dimension(:), allocatable wat_phi12

  wave celerity when reach is at 0.1 bankfull depth (low flow) (m/s)
- real ∗8, dimension(:), allocatable wat_phi13

  storage time constant for reach at 0.1 bankfull depth (low flow) (ratio of storage to discharge) (hour)
- real ∗8, dimension(:,:), allocatable snoeb

  snow water content in elevation band on current day (mm H2O)
- real ∗8, dimension(:,:), allocatable wudeep

  average daily water removal from the deep aquifer for the month for the HRU within the subbasin (10^4 m^3/day)
- real ∗8, dimension(:,:), allocatable wushal

  average daily water removal from the shallow aquifer for the month for the HRU within the subbasin (10^4 m^3/day)
- real ∗8, dimension(:,:), allocatable tmnband

  minimum temperature for the day in band in HRU (deg C)
- real ∗8, dimension(:,:), allocatable bss

  bss(1,:) amount of lateral flow lagged (mm H2O)
  bss(2,:) amount of nitrate in lateral flow lagged (kg N/ha)
  bss(3,:) amount of tile flow lagged (mm)
  bss(4,:) amount of nitrate in tile flow lagged (kg N/ha)
- real ∗8, dimension(:,:), allocatable nsetlw

  nsetlw(1,:) nitrogen settling rate for 1st season (m/day)
  nsetlw(2,:) nitrogen settling rate for 2nd season (m/day)
- real ∗8, dimension(:,:), allocatable snotmpeb

  temperature of snow pack in elevation band (deg C)
- real ∗8, dimension(:,:), allocatable surf_bs

  surf_bs(1,:) amount of surface runoff lagged over one day (mm H2O)
  surf_bs(2,:) amount of sediment yield lagged over one day (metric tons)
  surf_bs(3,:) amount of organic nitrogen loading lagged over one day (kg N/ha)
  surf_bs(4,:) amount of organic phosphorus loading lagged over one day (kg P/ha)
  surf_bs(5,:) amount of nitrate loading in surface runoff lagged over one day (kg N/ha)
  surf_bs(6,:) amount of soluble phosphorus loading lagged over one day (kg P/ha)
  surf_bs(7,:) amount of active mineral phosphorus loading lagged over one day (kg P/ha)
  surf_bs(8,:) amount of stable mineral phosphorus loading lagged over one day (kg P/ha)
  surf_bs(9,:) amount of less persistent bacteria in solution lagged over one day (# colonies/ha)
  surf_bs(10,:) amount of persistent bacteria in solution lagged over one day (# colonies/ha)
  surf_bs(11,:) amount of less persistent bacteria sorbed lagged over one day (# colonies/ha)
  surf_bs(12,:) amount of persistent bacteria sorbed lagged over one day (# colonies/ha)

- real ∗8, dimension(:,:), allocatable nsetlp

    nsetlp(1,:) nitrogen settling rate for 1st season (m/day)
    nsetlp(2,:) nitrogen settling rate for 2nd season (m/day)

- real ∗8, dimension(:,:), allocatable tmxband

    maximum temperature for the day in band in HRU (deg C)

- real ∗8, dimension(:,:), allocatable frad

    fraction of solar radiation occuring during hour in day in HRU (none)

- real ∗8, dimension(:,:), allocatable rainsub

    precipitation for the time step during the day in HRU (mm H2O)

- real ∗8, dimension(:), allocatable **rstpbsb**
- real ∗8, dimension(:,:), allocatable **orig_snoeb**
- real ∗8, dimension(:,:), allocatable **orig_pltpst**
- real ∗8, dimension(:,:), allocatable **terr_p**
- real ∗8, dimension(:,:), allocatable **terr_cn**
- real ∗8, dimension(:,:), allocatable **terr_sl**
- real ∗8, dimension(:,:), allocatable **drain_d**
- real ∗8, dimension(:,:), allocatable **drain_t**
- real ∗8, dimension(:,:), allocatable **drain_g**
- real ∗8, dimension(:,:), allocatable **drain_idep**
- real ∗8, dimension(:,:), allocatable **cont_cn**
- real ∗8, dimension(:,:), allocatable **cont_p**
- real ∗8, dimension(:,:), allocatable **filt_w**
- real ∗8, dimension(:,:), allocatable **strip_n**
- real ∗8, dimension(:,:), allocatable **strip_cn**
- real ∗8, dimension(:,:), allocatable **strip_c**
- real ∗8, dimension(:,:), allocatable **strip_p**
- real ∗8, dimension(:,:), allocatable **fire_cn**
- real ∗8, dimension(:,:), allocatable **cropno_upd**
- real ∗8, dimension(:,:), allocatable **hi_upd**
- real ∗8, dimension(:,:), allocatable **laimx_upd**
- real ∗8, dimension(:,:,:), allocatable phug

    fraction of plant heat units at which grazing begins (none)

- real ∗8, dimension(:,:,:), allocatable pst_lag

    pst_lag(1,:,:) amount of soluble pesticide in surface runoff lagged (kg pst/ha)
    pst_lag(2,:,:) amount of sorbed pesticide in surface runoff lagged (kg pst/ha)
    pst_lag(3,:,:) amount of pesticide lagged (kg pst/ha)

- integer, dimension(:), allocatable hrupest

    pesticide use flag (none)
    0: no pesticides used in HRU
    1: pesticides used in HRU

- integer, dimension(:), allocatable nrelease

    sequence number of impound/release operation within the year (none)

- integer, dimension(:), allocatable swtrg

    rainfall event flag (none):
    0: no rainfall event over midnight
    1: rainfall event over midnight

- integer, dimension(:), allocatable nrot

    number of years of rotation (none)

- integer, dimension(:), allocatable nfert

    sequence number of fertilizer application within the year (none)

- integer, dimension(:), allocatable nro

    sequence number of year in rotation (none)

- integer, dimension(:), allocatable igro

land cover status code (none). This code informs the model whether or not a land cover is growing at the beginning of the simulation
0 no land cover currently growing
1 land cover growing

- integer, dimension(:,:), allocatable ipnd

  ipnd(1,:) beginning month of 2nd "season" of nutrient settling season (none)
  ipnd(2,:) ending month of 2nd "season" of nutrient settling season (none)

- integer, dimension(:), allocatable nair

  sequence number of auto-irrigation application within the year (none)

- integer, dimension(:,:), allocatable iflod

  iflod(1,:) beginning month of non-flood season (none)
  iflod(2,:) ending month of non-flood season (none)

- integer, dimension(:), allocatable ndtarg

  number of days required to reach target storage from current pond storage (none)

- integer, dimension(:), allocatable nirr

  sequence number of irrigation application within the year (none)

- integer, dimension(:), allocatable nstress

  code for approach used to determine amount of nitrogen to HRU (none):
  0 nitrogen target approach
  1 annual max approach

- integer, dimension(:), allocatable **iafrttyp**
- integer, dimension(:), allocatable **igrotree**
- integer, dimension(:), allocatable grz_days

  number of days grazing will be simulated (none)

- integer, dimension(:), allocatable nmgt

  management code (for GIS output only) (none)

- integer, dimension(:), allocatable nafert

  sequence number of auto-fert application within the year (none)

- integer, dimension(:), allocatable nsweep

  sequence number of street sweeping operation within the year (none)

- integer, dimension(:), allocatable icr

  sequence number of crop grown within the current year (none)

- integer, dimension(:), allocatable ncut

  sequence number of harvest operation within a year (none)

- integer, dimension(:), allocatable irrno

  irrigation source location (none)
  if IRRSC=1, IRRNO is the number of the reach
  if IRRSC=2, IRRNO is the number of the reservoir
  if IRRSC=3, IRRNO is the number of the subbasin
  if IRRSC=4, IRRNO is the number of the subbasin
  if IRRSC=5, not used

- integer, dimension(:), allocatable sol_nly

  number of soil layers in HRU (none)

- integer, dimension(:), allocatable npcp

  prior day category (none)
  1 dry day
  2 wet day

- integer, dimension(:), allocatable irn

  average annual number of irrigation applications in HRU (none)

- integer, dimension(:), allocatable ncf

  sequence number of continuous fertilization operation within the year (none)

- integer, dimension(:), allocatable ngr

  sequence number of grazing operation within the year (none)

- integer, dimension(:), allocatable igrz

grazing flag for HRU (none):
0 HRU currently not grazed
1 HRU currently grazed

- integer, dimension(:), allocatable ndeat

  number of days HRU has been grazed (days)

- integer, dimension(:), allocatable hru_sub

  subbasin number in which HRU/reach is located (none)

- integer, dimension(:), allocatable urblu

  urban land type identification number from urban database (urban.dat) (none)

- integer, dimension(:), allocatable ldrain

  soil layer where drainage tile is located (none)

- integer, dimension(:), allocatable idorm

  dormancy status code (none):
  0 land cover growing (not dormant)
  1 land cover dormant

- integer, dimension(:), allocatable **hru_seq**
- integer, dimension(:), allocatable iurban

  urban simulation code (none):
  0 no urban sections in HRU
  1 urban sections in HRU, simulate using USGS regression equations
  2 urban sections in HRU, simulate using build up/wash off algorithm

- integer, dimension(:), allocatable icfrt

  continuous fertilizer flag for HRU (none):
  0 HRU currently not continuously fertilized
  1 HRU currently continuously fertilized

- integer, dimension(:), allocatable **iday_fert**
- integer, dimension(:), allocatable ifld

  number of HRU (in subbasin) that is a floodplain (none)

- integer, dimension(:), allocatable irip

  number of HRU (in subbasin) that is a riparian zone (none)

- integer, dimension(:), allocatable hrugis

  GIS code printed to output files (output.hru, output.rch) (none)

- integer, dimension(:), allocatable ndcfrt

  number of days HRU has been continuously fertilized (days)

- integer, dimension(:), allocatable irrsc

  irrigation source code (none):
  1 divert water from reach
  2 divert water from reservoir
  3 divert water from shallow aquifer
  4 divert water from deep aquifer
  5 divert water from source outside watershed

- integer, dimension(:), allocatable ntil

  sequence number of tillage operation within current year (none)

- integer, dimension(:), allocatable **orig_igro**
- integer, dimension(:), allocatable iwatable

  high water table code (none):
  0 no high water table
  1 high water table

- integer, dimension(:), allocatable **curyr_mat**
- integer, dimension(:), allocatable icpst

  icpst = 0 do not apply
  icpst = 1 application period

- integer, dimension(:), allocatable ndcpst

  current day within the application period (day)

- integer, dimension(:), allocatable **ncpest**
- integer, dimension(:), allocatable iday_pest

  current day between applications (day)
- integer, dimension(:), allocatable **irr_flag**
- integer, dimension(:), allocatable **irra_flag**
- integer, dimension(:,:), allocatable rndseed

  random number generator seeds array. The seeds in the array are used to generate random numbers for the following purposes (none):
  (1) wet/dry day probability
  (2) solar radiation
  (3) precipitation
  (4) USLE rainfall erosion index
  (5) wind speed
  (6) 0.5 hr rainfall fraction
  (7) relative humidity
  (8) maximum temperature
  (9) minimum temperature
  (10) generate new random numbers
- integer, dimension(:,:), allocatable **iterr**
- integer, dimension(:,:), allocatable **iyterr**
- integer, dimension(:,:), allocatable **itdrain**
- integer, dimension(:,:), allocatable **iydrain**
- integer, dimension(:,:), allocatable **ncrops**
- integer, dimension(:), allocatable manure_id

  manure (fertilizer) identification number from fert.dat (none)
- integer, dimension(:,:), allocatable **mgt_sdr**
- integer, dimension(:,:), allocatable **idplrot**
- integer, dimension(:,:), allocatable **icont**
- integer, dimension(:,:), allocatable **iycont**
- integer, dimension(:,:), allocatable **ifilt**
- integer, dimension(:,:), allocatable **iyfilt**
- integer, dimension(:,:), allocatable **istrip**
- integer, dimension(:,:), allocatable **iystrip**
- integer, dimension(:,:), allocatable **iopday**
- integer, dimension(:,:), allocatable **iopyr**
- integer, dimension(:,:), allocatable **mgt_ops**
- real ∗8, dimension(:), allocatable wshd_pstap

  total amount of pesticide type applied in watershed during simulation (kg/ha)
- real ∗8, dimension(:), allocatable wshd_pstdg

  amount of pesticide lost through degradation in watershed (kg pst/ha)
- integer, dimension(12) **ndmo**
- integer, dimension(:), allocatable npno

  array of unique pesticides used in watershed (none)
- integer, dimension(:), allocatable **mcrhru**
- character(len=13), dimension(18) rfile

  rainfall file names (.pcp)
- character(len=13), dimension(18) tfile

  temperature file names (.tmp)
- character(len=4), dimension(1000) urbname

  name of urban land use
- character(len=1), dimension(:), allocatable kirr

  irrigation in HRU
- character(len=1), dimension(:), allocatable **hydgrp**
- character(len=16), dimension(:), allocatable snam

soil series name

- character(len=17), dimension(300) pname

  name of pesticide/toxin

- character(len=4), dimension(60) title

  description lines in file.cio (1st 3 lines)

- character(len=4), dimension(5000) cpnm

  four character code to represent crop name

- character(len=17), dimension(50) **fname**
- real ∗8, dimension(:,:,:), allocatable flomon

  average daily water loading for month (m^ 3/day)

- real ∗8, dimension(:,:,:), allocatable solpstmon

  average daily soluble pesticide loading for month (mg pst/day)

- real ∗8, dimension(:,:,:), allocatable srbpstmon

  average daily sorbed pesticide loading for month (mg pst/day)

- real ∗8, dimension(:,:,:), allocatable orgnmon

  average daily organic N loading for month (kg N/day)

- real ∗8, dimension(:,:,:), allocatable orgpmon

  average daily organic P loading for month (kg P/day)

- real ∗8, dimension(:,:,:), allocatable sedmon

  average daily sediment loading for month (metric tons/day)

- real ∗8, dimension(:,:,:), allocatable minpmon

  average daily mineral P loading for month (kg P/day)

- real ∗8, dimension(:,:,:), allocatable nh3mon

  average amount of NH3-N loaded to stream on a given day in the month (kg N/day)

- real ∗8, dimension(:,:,:), allocatable no3mon

  average daily NO3-N loading for month (kg N/day)

- real ∗8, dimension(:,:,:), allocatable bactlpmon

  average amount of less persistent bacteria loaded to stream on a given day in the month (# bact/day)

- real ∗8, dimension(:,:,:), allocatable bactpmon

  average amount of persistent bacteria loaded to stream on a given day in the month (# bact/day)

- real ∗8, dimension(:,:,:), allocatable no2mon

  average amount of NO2-N loaded to stream on a given day in the month (kg N/day)

- real ∗8, dimension(:,:,:), allocatable cmtl1mon

  average amount of conservative metal #1 loaded to stream on a given day in the month (# bact/day)

- real ∗8, dimension(:,:,:), allocatable cmtl2mon

  average amount of conservative metal #2 loaded to stream on a given day in the month (# bact/day)

- real ∗8, dimension(:,:,:), allocatable cmtl3mon

  average amount of conservative metal #3 loaded to stream on a given day in the month (# bact/day)

- real ∗8, dimension(:,:,:), allocatable cbodmon

  average daily loading of CBOD in month (kg/day)

- real ∗8, dimension(:,:,:), allocatable chlamon

  average daily loading of chlorophyll-a in month (kg/day)

- real ∗8, dimension(:,:,:), allocatable disoxmon

  average daily loading of dissolved O2 in month (kg/day)

- real ∗8, dimension(:,:), allocatable floyr

  average daily water loading for year (m^ 3/day)

- real ∗8, dimension(:,:), allocatable orgnyr

  average daily organic N loading for year (kg N/day)

- real ∗8, dimension(:,:), allocatable orgpyr

  average daily organic P loading for year (kg P/day)

- real ∗8, dimension(:,:), allocatable sedyr

average daily sediment loading for year (metric tons/day)
- real ∗8, dimension(:,:), allocatable minpyr

  average daily mineral P loading for year (kg P/day)
- real ∗8, dimension(:,:), allocatable nh3yr

  average daily NH3-N loading for year (kg N/day)
- real ∗8, dimension(:,:), allocatable no2yr

  average daily NO2-N loading for year (kg N/day)
- real ∗8, dimension(:,:), allocatable no3yr

  average daily NO3-N loading for year (kg N/day)
- real ∗8, dimension(:,:), allocatable bactlpyr

  average daily loading of less persistent bacteria for year (# bact/day)
- real ∗8, dimension(:,:), allocatable bactpyr

  average daily loading of persistent bacteria for year (# bact/day)
- real ∗8, dimension(:,:), allocatable cmtl1yr

  average daily loading of conservative metal #1 for year (kg/day)
- real ∗8, dimension(:,:), allocatable chlayr

  average daily loading of chlorophyll-a in year (kg/day)
- real ∗8, dimension(:,:), allocatable cmtl2yr

  average daily loading of conservative metal #2 for year (kg/day)
- real ∗8, dimension(:,:), allocatable cmtl3yr

  average daily loading of conservative metal #3 for year (kg/day)
- real ∗8, dimension(:,:), allocatable cbodyr

  average daily loading of CBOD in year (kg/day)
- real ∗8, dimension(:,:), allocatable disoxyr

  average daily loading of dissolved O2 in year (kg/day)
- real ∗8, dimension(:,:), allocatable solpstyr

  average daily soluble pesticide loading for year (mg pst/day)
- real ∗8, dimension(:,:), allocatable srbpstyr

  average daily sorbed pesticide loading for year (mg pst/day)
- real ∗8, dimension(:,:), allocatable **sol_mc**
- real ∗8, dimension(:,:), allocatable **sol_mn**
- real ∗8, dimension(:,:), allocatable **sol_mp**
- real ∗8, dimension(:), allocatable **flocnst**
- real ∗8, dimension(:), allocatable orgncnst

  average daily organic N loading to reach (kg N/day)
- real ∗8, dimension(:), allocatable sedcnst

  average daily sediment loading for reach (metric tons/day)
- real ∗8, dimension(:), allocatable minpcnst

  average daily soluble P loading to reach (kg P/day)
- real ∗8, dimension(:), allocatable no3cnst

  average daily nitrate loading to reach (kg N/day)
- real ∗8, dimension(:), allocatable orgpcnst

  average daily organic P loading to reach (kg P/day)
- real ∗8, dimension(:), allocatable bactpcnst

  average daily persistent bacteria loading to reach (# bact/day)
- real ∗8, dimension(:), allocatable nh3cnst

  average daily ammonia loading to reach (kg N/day)
- real ∗8, dimension(:), allocatable no2cnst

  average daily nitrite loading to reach (kg N/day)
- real ∗8, dimension(:), allocatable bactlpcnst

  average daily less persistent bacteria loading to reach (# bact/day)

- real ∗8, dimension(:), allocatable cmtl1cnst

  average daily conservative metal #1 loading (kg/day)
- real ∗8, dimension(:), allocatable cmtl2cnst

  average daily conservative metal #2 loading (kg/day)
- real ∗8, dimension(:), allocatable chlacnst

  average daily loading of chlorophyll-a (kg/day)
- real ∗8, dimension(:), allocatable cmtl3cnst

  average daily conservative metal #3 loading (kg/day)
- real ∗8, dimension(:), allocatable disoxcnst

  average daily loading of dissolved O2 (kg/day)
- real ∗8, dimension(:), allocatable cbodcnst

  average daily loading of CBOD to reach (kg/day)
- real ∗8, dimension(:), allocatable solpstcnst

  average daily soluble pesticide loading (mg/day)
- real ∗8, dimension(:), allocatable srbpstcnst

  average daily sorbed pesticide loading (mg/day)
- integer nstep

  max number of time steps per day or number of lines of rainfall data for each day (depends on model operational time step) (none)
- integer idt

  length of time step used to report precipitation data for sub-daily modeling (operational time step) (minutes)
- real ∗8, dimension(:), allocatable hdepth

  depth of flow during hour (m)
- real ∗8, dimension(:), allocatable hhstor

  water stored in reach at end of hour (m^3 H2O)
- real ∗8, dimension(:), allocatable hrtwtr

  water leaving reach in hour (m^3)
- real ∗8, dimension(:), allocatable hsdti

  flow rate in reach for hour (m^3/s)
- real ∗8, dimension(:), allocatable hrchwtr

  water stored in reach at beginning of hour (m^3 H2O)
- real ∗8, dimension(:), allocatable hnh4

  ammonia concentration in reach at end of hour (mg N/L)
- real ∗8, dimension(:), allocatable horgn

  organic nitrogen concentration in reach at end of hour (mg N/L)
- real ∗8, dimension(:), allocatable **halgae**
- real ∗8, dimension(:), allocatable hbod

  carbonaceous biochemical oxygen demand in reach at end of hour (mg O2/L)
- real ∗8, dimension(:), allocatable hno2

  nitrite concentration in reach at end of hour (mg N/L)
- real ∗8, dimension(:), allocatable hno3

  nitrate concentration in reach at end of hour (mg N/L)
- real ∗8, dimension(:), allocatable horgp

  organic phosphorus concentration in reach at end of hour (mg P/L)
- real ∗8, dimension(:), allocatable hsolp

  dissolved phosphorus concentration in reach at end of hour (mg P/L)
- real ∗8, dimension(:), allocatable hchla

  chlorophyll-a concentration in reach at end of hour (mg chl-a/L)
- real ∗8, dimension(:), allocatable hdisox

  dissolved oxygen concentration in reach at end of hour (mg O2/L)
- real ∗8, dimension(:), allocatable hsedyld

sediment transported out of reach during hour (metric tons)

- real ∗8, dimension(:), allocatable **hsedst**
- real ∗8, dimension(:), allocatable hharea

  cross-sectional area of flow (m^2)
- real ∗8, dimension(:), allocatable hsolpst

  soluble pesticide concentration in outflow on day (mg pst/m^3)
- real ∗8, dimension(:), allocatable hsorpst

  sorbed pesticide concentration in outflow on day (mg pst/m^3)
- real ∗8, dimension(:), allocatable hhqday

  surface runoff generated each timestep of day in HRU (mm H2O)
- real ∗8, dimension(:), allocatable precipdt

  precipitation, or effective precipitation reaching soil surface, in time step for HRU (mm H2O)
- real ∗8, dimension(:), allocatable hhtime

  travel time of flow in reach for hour (hour)
- real ∗8, dimension(:), allocatable hbactlp

  less persistent bacteria in reach/outflow during hour (# cfu/100mL)
- real ∗8, dimension(:), allocatable hbactp

  persistent bacteria in reach/outflow during hour (# cfu/100mL)
- integer, dimension(10) **ivar_orig**
- real ∗8, dimension(10) **rvar_orig**
- integer nsave

  number of save commands in .fig file
- integer **nauto**
- integer **iatmodep**
- real ∗8, dimension(:), allocatable **wattemp**
- real ∗8, dimension(:), allocatable **lkpst_mass**
- real ∗8, dimension(:), allocatable **lkspst_mass**
- real ∗8, dimension(:), allocatable **vel_chan**
- real ∗8, dimension(:), allocatable vfscon

  fraction of the total runoff from the entire field entering the most concentrated 10% of the VFS (none)
- real ∗8, dimension(:), allocatable vfsratio

  field area/VFS area ratio (none)
- real ∗8, dimension(:), allocatable vfsch

  fraction of flow entering the most concentrated 10% of the VFS which is fully channelized (none)
- real ∗8, dimension(:), allocatable **vfsi**
- real ∗8, dimension(:,:), allocatable **filter_i**
- real ∗8, dimension(:,:), allocatable **filter_ratio**
- real ∗8, dimension(:,:), allocatable **filter_con**
- real ∗8, dimension(:,:), allocatable **filter_ch**
- real ∗8, dimension(:,:), allocatable **sol_n**
- integer cswat

  = 0 Static soil carbon (old mineralization routines)
  = 1 C-FARM one carbon pool model
  = 2 Century model
- real ∗8, dimension(:,:), allocatable **sol_bdp**
- real ∗8, dimension(:,:), allocatable **tillagef**
- real ∗8, dimension(:), allocatable **rtfr**
- real ∗8, dimension(:), allocatable stsol_rd

  storing last soil root depth for use in harvestkillop/killop (mm)
- integer **urban_flag**
- integer **dorm_flag**
- real ∗8 **bf_flg**
- real ∗8 **iabstr**

- real ∗8, dimension(:), allocatable ubntss

  TSS loading from urban impervious cover (metric tons)
- real ∗8, dimension(:), allocatable ubnrunoff

  surface runoff from urban impervious cover (mm H2O)
- real ∗8, dimension(:,:), allocatable sub_ubnrunoff

  surface runoff from urban impervious cover in subbasin (mm H2O)
- real ∗8, dimension(:,:), allocatable sub_ubntss

  TSS loading from urban impervious cover in subbasin (metric tons)
- real ∗8, dimension(:,:), allocatable **ovrlnd_dt**
- real ∗8, dimension(:,:,:), allocatable **hhsurf_bs**
- integer iuh

  unit hydrograph method: 1=triangular UH; 2=gamma funtion UH;
- integer sed_ch

  channel routing for HOURLY; 0=Bagnold; 2=Brownlie; 3=Yang;
- real ∗8 eros_expo

  an exponent in the overland flow erosion equation ranges 1.5-3.0
- real ∗8 eros_spl

  coefficient of splash erosion varing 0.9-3.1
- real ∗8 rill_mult

  Multiplier to USLE_K for soil susceptible to rill erosion, range 0.5-2.0.
- real ∗8 **sedprev**
- real ∗8 **c_factor**
- real ∗8 ch_d50

  median particle diameter of channel bed (mm)
- real ∗8 sig_g

  geometric standard deviation of particle sizes for the main channel. Mean air temperature at which precipitation is equally likely to be rain as snow/freezing rain.
- real ∗8 uhalpha

  alpha coefficient for estimating unit hydrograph using a gamma function (∗.bsn)
- real ∗8 **abstinit**
- real ∗8 **abstmax**
- real ∗8, dimension(:,:), allocatable hhsedy

  sediment yield from HRU drung a time step applied to HRU (tons)
- real ∗8, dimension(:,:), allocatable sub_subp_dt

  precipitation for time step in subbasin (mm H2O)
- real ∗8, dimension(:,:), allocatable sub_hhsedy

  sediment yield for the time step in subbasin (metric tons)
- real ∗8, dimension(:,:), allocatable **sub_atmp**
- real ∗8, dimension(:), allocatable rhy

  main channel hydraulic radius (m H2O)
- real ∗8, dimension(:), allocatable **init_abstrc**
- real ∗8, dimension(:), allocatable hrtevp

  evaporation losses for hour (m^3 H2O)
- real ∗8, dimension(:), allocatable hrttlc

  transmission losses for hour (m^3 H2O)
- real ∗8, dimension(:), allocatable **dratio**
- real ∗8, dimension(:,:,:), allocatable **rchhr**
- real ∗8, dimension(:), allocatable **hhresflwi**
- real ∗8, dimension(:), allocatable **hhresflwo**
- real ∗8, dimension(:), allocatable **hhressedi**
- real ∗8, dimension(:), allocatable **hhressedo**
- character(len=4), dimension(:), allocatable **lu_nodrain**

- integer, dimension(:), allocatable **bmpdrain**
- real ∗8, dimension(:), allocatable **sub_cn2**
- real ∗8, dimension(:), allocatable **sub_ha_urb**
- real ∗8, dimension(:), allocatable **bmp_recharge**
- real ∗8, dimension(:), allocatable **sub_ha_imp**
- real ∗8, dimension(:), allocatable **subdr_km**
- real ∗8, dimension(:), allocatable **subdr_ickm**
- real ∗8, dimension(:,:), allocatable **sf_im**
- real ∗8, dimension(:,:), allocatable **sf_iy**
- real ∗8, dimension(:,:), allocatable **sp_sa**
- real ∗8, dimension(:,:), allocatable **sp_pvol**
- real ∗8, dimension(:,:), allocatable **sp_pd**
- real ∗8, dimension(:,:), allocatable **sp_sedi**
- real ∗8, dimension(:,:), allocatable **sp_sede**
- real ∗8, dimension(:,:), allocatable **ft_sa**
- real ∗8, dimension(:,:), allocatable **ft_fsa**
- real ∗8, dimension(:,:), allocatable **ft_dep**
- real ∗8, dimension(:,:), allocatable **ft_h**
- real ∗8, dimension(:,:), allocatable **ft_pd**
- real ∗8, dimension(:,:), allocatable **ft_k**
- real ∗8, dimension(:,:), allocatable **ft_dp**
- real ∗8, dimension(:,:), allocatable **ft_dc**
- real ∗8, dimension(:,:), allocatable **ft_por**
- real ∗8, dimension(:,:), allocatable **tss_den**
- real ∗8, dimension(:,:), allocatable **ft_alp**
- real ∗8, dimension(:,:), allocatable **sf_fr**
- real ∗8, dimension(:,:), allocatable **sp_qi**
- real ∗8, dimension(:,:), allocatable **sp_k**
- real ∗8, dimension(:,:), allocatable **ft_qpnd**
- real ∗8, dimension(:,:), allocatable **sp_dp**
- real ∗8, dimension(:,:), allocatable **ft_qsw**
- real ∗8, dimension(:,:), allocatable **ft_qin**
- real ∗8, dimension(:,:), allocatable **ft_qout**
- real ∗8, dimension(:,:), allocatable **ft_sedpnd**
- real ∗8, dimension(:,:), allocatable **sp_bpw**
- real ∗8, dimension(:,:), allocatable **ft_bpw**
- real ∗8, dimension(:,:), allocatable **ft_sed_cumul**
- real ∗8, dimension(:,:), allocatable **sp_sed_cumul**
- integer, dimension(:), allocatable **num_sf**
- integer, dimension(:,:), allocatable **sf_typ**
- integer, dimension(:,:), allocatable **sf_dim**
- integer, dimension(:,:), allocatable **ft_qfg**
- integer, dimension(:,:), allocatable **sp_qfg**
- integer, dimension(:,:), allocatable **sf_ptp**
- integer, dimension(:,:), allocatable **ft_fc**
- real ∗8 **sfsedmean**
- real ∗8 **sfsedstdev**
- integer, dimension(:), allocatable dtp_imo

  month the reservoir becomes operational (none)
- integer, dimension(:), allocatable dtp_iyr

  year of the simulation that the reservoir becomes operational (none)
- integer, dimension(:), allocatable dtp_numstage

  total number of stages in the weir (none)
- integer, dimension(:), allocatable dtp_numweir

total number of weirs in the BMP (none)

- integer, dimension(:), allocatable dtp_onoff

  sub-basin detention pond is associated with (none)
- integer, dimension(:), allocatable dtp_reltype

  equations for stage-discharge relationship (none):
  1=exponential function,
  2=linear,
  3=logarithmic,
  4=cubic,
  5=power
- integer, dimension(:), allocatable dtp_stagdis

  (none):
  0=use weir/orifice discharge equation to calculate outflow,
  1=use stage-dicharge relationship
- integer, dimension(:), allocatable **dtp_subnum**
- real ∗8, dimension(:), allocatable cf

  this parameter controls the response of decomposition to the combined effect of soil temperature and moisture.
- real ∗8, dimension(:), allocatable cfh

  maximum humification rate
- real ∗8, dimension(:), allocatable cfdec

  the undisturbed soil turnover rate under optimum soil water and temperature. Increasing it will increase carbon and organic N decomp.
- real ∗8, dimension(:), allocatable **lat_orgn**
- real ∗8, dimension(:), allocatable **lat_orgp**
- integer, dimension(:,:), allocatable dtp_weirdim

  weir dimensions (none),
  1=read user input,
  0=use model calculation
- integer, dimension(:,:), allocatable dtp_weirtype

  type of weir (none):
  1=rectangular and
  2=circular
- real ∗8, dimension(:), allocatable dtp_coef1

  coefficient of 3rd degree in the polynomial equation (none)
- real ∗8, dimension(:), allocatable dtp_coef2

  coefficient of 2nd degree in the polynomial equation (none)
- real ∗8, dimension(:), allocatable dtp_coef3

  coefficient of 1st degree in the polynomial equation (none)
- real ∗8, dimension(:), allocatable dtp_evrsv

  detention pond evaporation coefficient (none)
- real ∗8, dimension(:), allocatable dtp_expont

  exponent used in the exponential equation (none)
- real ∗8, dimension(:), allocatable dtp_intcept

  intercept used in regression equations (none)
- real ∗8, dimension(:), allocatable dtp_lwratio

  ratio of length to width of water back up (none)
- real ∗8, dimension(:), allocatable dtp_totwrwid

  total constructed width of the detention wall across the creek (m)
- real ∗8, dimension(:), allocatable **dtp_inflvol**
- real ∗8, dimension(:), allocatable **dtp_wdep**
- real ∗8, dimension(:), allocatable **dtp_totdep**
- real ∗8, dimension(:), allocatable **dtp_watdepact**
- real ∗8, dimension(:), allocatable **dtp_outflow**
- real ∗8, dimension(:), allocatable **dtp_totrel**

- real ∗8, dimension(:), allocatable **dtp_backoff**
- real ∗8, dimension(:), allocatable **dtp_seep_sa**
- real ∗8, dimension(:), allocatable **dtp_evap_sa**
- real ∗8, dimension(:), allocatable **dtp_pet_day**
- real ∗8, dimension(:), allocatable **dtp_pcpvol**
- real ∗8, dimension(:), allocatable **dtp_seepvol**
- real ∗8, dimension(:), allocatable **dtp_evapvol**
- real ∗8, dimension(:), allocatable **dtp_flowin**
- real ∗8, dimension(:), allocatable **dtp_backup_length**
- real ∗8, dimension(:), allocatable **dtp_ivol**
- real ∗8, dimension(:), allocatable **dtp_ised**
- integer, dimension(:,:), allocatable **so_res_flag**
- integer, dimension(:,:), allocatable **ro_bmp_flag**
- real ∗8, dimension(:,:), allocatable **sol_watp**
- real ∗8, dimension(:,:), allocatable **sol_solp_pre**
- real ∗8, dimension(:,:), allocatable **psp_store**
- real ∗8, dimension(:,:), allocatable **ssp_store**
- real ∗8, dimension(:,:), allocatable **so_res**
- real ∗8, dimension(:,:), allocatable **sol_cal**
- real ∗8, dimension(:,:), allocatable **sol_ph**
- integer **sol_p_model**
- integer, dimension(:,:), allocatable **a_days**
- integer, dimension(:,:), allocatable **b_days**
- real ∗8, dimension(:), allocatable min_res

    minimum residue allowed due to implementation of residue managment in the OPS file (kg/ha)
- real ∗8, dimension(:), allocatable **harv_min**
- real ∗8, dimension(:), allocatable **fstap**
- real ∗8, dimension(:,:), allocatable **ro_bmp_flo**
- real ∗8, dimension(:,:), allocatable **ro_bmp_sed**
- real ∗8, dimension(:,:), allocatable **ro_bmp_bac**
- real ∗8, dimension(:,:), allocatable **ro_bmp_pp**
- real ∗8, dimension(:,:), allocatable **ro_bmp_sp**
- real ∗8, dimension(:,:), allocatable **ro_bmp_pn**
- real ∗8, dimension(:,:), allocatable **ro_bmp_sn**
- real ∗8, dimension(:,:), allocatable **ro_bmp_flos**
- real ∗8, dimension(:,:), allocatable **ro_bmp_seds**
- real ∗8, dimension(:,:), allocatable **ro_bmp_bacs**
- real ∗8, dimension(:,:), allocatable **ro_bmp_pps**
- real ∗8, dimension(:,:), allocatable **ro_bmp_sps**
- real ∗8, dimension(:,:), allocatable **ro_bmp_pns**
- real ∗8, dimension(:,:), allocatable **ro_bmp_sns**
- real ∗8, dimension(:,:), allocatable **ro_bmp_flot**
- real ∗8, dimension(:,:), allocatable **ro_bmp_sedt**
- real ∗8, dimension(:,:), allocatable **ro_bmp_bact**
- real ∗8, dimension(:,:), allocatable **ro_bmp_ppt**
- real ∗8, dimension(:,:), allocatable **ro_bmp_spt**
- real ∗8, dimension(:,:), allocatable **ro_bmp_pnt**
- real ∗8, dimension(:,:), allocatable **ro_bmp_snt**
- real ∗8, dimension(:), allocatable **bmp_flo**
- real ∗8, dimension(:), allocatable **bmp_sed**
- real ∗8, dimension(:), allocatable **bmp_bac**
- real ∗8, dimension(:), allocatable **bmp_pp**
- real ∗8, dimension(:), allocatable **bmp_sp**
- real ∗8, dimension(:), allocatable **bmp_pn**

- real ∗8, dimension(:), allocatable **bmp_sn**
- real ∗8, dimension(:), allocatable **bmp_flag**
- real ∗8, dimension(:), allocatable **bmp_flos**
- real ∗8, dimension(:), allocatable **bmp_seds**
- real ∗8, dimension(:), allocatable **bmp_bacs**
- real ∗8, dimension(:), allocatable **bmp_pps**
- real ∗8, dimension(:), allocatable **bmp_sps**
- real ∗8, dimension(:), allocatable **bmp_pns**
- real ∗8, dimension(:), allocatable **bmp_sns**
- real ∗8, dimension(:), allocatable **bmp_flot**
- real ∗8, dimension(:), allocatable **bmp_sedt**
- real ∗8, dimension(:), allocatable **bmp_bact**
- real ∗8, dimension(:), allocatable **bmp_ppt**
- real ∗8, dimension(:), allocatable **bmp_spt**
- real ∗8, dimension(:), allocatable **bmp_pnt**
- real ∗8, dimension(:), allocatable **bmp_snt**
- real ∗8, dimension(:,:), allocatable dtp_addon

  the distance between spillway levels (m)
- real ∗8, dimension(:,:), allocatable dtp_cdis

  discharge coefficient for weir/orifice flow at different stages (none)
- real ∗8, dimension(:,:), allocatable dtp_depweir

  depth of rectangular weir at different stages (m)
- real ∗8, dimension(:,:), allocatable dtp_diaweir

  diameter of circular weir at different stages (m)
- real ∗8, dimension(:,:), allocatable dtp_flowrate

  maximum discharge from each stage of the weir/hole (m^3/s)
- real ∗8, dimension(:,:), allocatable dtp_pcpret

  precipitation for different return periods (not used) (mm)
- real ∗8, dimension(:,:), allocatable dtp_retperd

  return period at different stages (years)
- real ∗8, dimension(:,:), allocatable dtp_wdratio

  width depth ratio of rectangular weirs at different stages (none)
- real ∗8, dimension(:,:), allocatable **dtp_wrwid**
- real ∗8, dimension(:), allocatable **ri_subkm**
- real ∗8, dimension(:), allocatable **ri_totpvol**
- real ∗8, dimension(:), allocatable **irmmdt**
- real ∗8, dimension(:,:), allocatable ri_sed

  total sediment deposited in the pond (tons)
- real ∗8, dimension(:,:), allocatable **ri_fr**
- real ∗8, dimension(:,:), allocatable **ri_dim**
- real ∗8, dimension(:,:), allocatable **ri_im**
- real ∗8, dimension(:,:), allocatable **ri_iy**
- real ∗8, dimension(:,:), allocatable **ri_sa**
- real ∗8, dimension(:,:), allocatable **ri_vol**
- real ∗8, dimension(:,:), allocatable **ri_qi**
- real ∗8, dimension(:,:), allocatable **ri_k**
- real ∗8, dimension(:,:), allocatable **ri_dd**
- real ∗8, dimension(:,:), allocatable **ri_evrsv**
- real ∗8, dimension(:,:), allocatable **ri_dep**
- real ∗8, dimension(:,:), allocatable **ri_ndt**
- real ∗8, dimension(:,:), allocatable **ri_pmpvol**
- real ∗8, dimension(:,:), allocatable **ri_sed_cumul**
- real ∗8, dimension(:,:), allocatable **hrnopcp**

- real ∗8, dimension(:,:), allocatable **ri_qloss**
- real ∗8, dimension(:,:), allocatable **ri_pumpv**
- real ∗8, dimension(:,:), allocatable **ri_sedi**
- character(len=4), dimension(:,:), allocatable **ri_nirr**
- integer, dimension(:), allocatable **num_ri**
- integer, dimension(:), allocatable **ri_luflg**
- integer, dimension(:), allocatable **num_noirr**
- integer, dimension(:), allocatable **wtp_subnum**
- integer, dimension(:), allocatable **wtp_onoff**
- integer, dimension(:), allocatable **wtp_imo**
- integer, dimension(:), allocatable **wtp_iyr**
- integer, dimension(:), allocatable **wtp_dim**
- integer, dimension(:), allocatable **wtp_stagdis**
- integer, dimension(:), allocatable **wtp_sdtype**
- real ∗8, dimension(:), allocatable wtp_evrsv

  detention pond evaporation coefficient (none)
- real ∗8, dimension(:), allocatable wtp_pvol

  volume of permanent pool including forebay (m^3 H2O)
- real ∗8, dimension(:), allocatable **wtp_pdepth**
- real ∗8, dimension(:), allocatable **wtp_sdslope**
- real ∗8, dimension(:), allocatable **wtp_lenwdth**
- real ∗8, dimension(:), allocatable **wtp_extdepth**
- real ∗8, dimension(:), allocatable **wtp_hydeff**
- real ∗8, dimension(:), allocatable **wtp_sdintc**
- real ∗8, dimension(:), allocatable **wtp_sdexp**
- real ∗8, dimension(:), allocatable **wtp_sdc1**
- real ∗8, dimension(:), allocatable **wtp_sdc2**
- real ∗8, dimension(:), allocatable **wtp_sdc3**
- real ∗8, dimension(:), allocatable **wtp_pdia**
- real ∗8, dimension(:), allocatable **wtp_plen**
- real ∗8, dimension(:), allocatable **wtp_pmann**
- real ∗8, dimension(:), allocatable **wtp_ploss**
- real ∗8, dimension(:), allocatable **wtp_k**
- real ∗8, dimension(:), allocatable **wtp_dp**
- real ∗8, dimension(:), allocatable **wtp_sedi**
- real ∗8, dimension(:), allocatable **wtp_sede**
- real ∗8, dimension(:), allocatable **wtp_qi**
- real ∗8 lai_init

  initial leaf area index of transplants
- real ∗8 bio_init

  initial biomass of transplants (kg/ha)
- real ∗8 cnop

  SCS runoff curve number for moisture condition II (none)
- real ∗8 harveff

  harvest efficiency: fraction of harvested yield that is removed from HRU; the remainder becomes residue on the soil surface(none)
- real ∗8 hi_ovr

  harvest index target specified at harvest ((kg/ha)/(kg/ha))
- real ∗8 **frac_harvk**
- real ∗8 lid_vgcl

  van Genuchten equation's coefficient, l (none)
- real ∗8 lid_vgcm

  van Genuchten equation's coefficient, m (none)

- real ∗8 **lid_qsurf_total**
- real ∗8 **lid_farea_sum**
- real ∗8, dimension(:,:), allocatable lid_cuminf_last

    cumulative amount of water infiltrated into the amended soil layer at the last time step in a day (mm H2O)
- real ∗8, dimension(:,:), allocatable lid_cumr_last

    cumulative amount of rainfall at the last time step in a day (mm H2O)
- real ∗8, dimension(:,:), allocatable lid_excum_last

    cumulative amount of excess rainfall at the last time step in a day (mm H2O)
- real ∗8, dimension(:,:), allocatable lid_f_last

    potential infiltration rate of the amended soil layer at the last time step in a day (mm/mm H2O)
- real ∗8, dimension(:,:), allocatable lid_sw_last

    soil water content of the amended soil layer at the last time step in a day (mm/mm H2O)
- real ∗8, dimension(:,:), allocatable lid_qsurf

    depth of runoff generated on a LID in a given time interval (mm H2O)
- real ∗8, dimension(:,:), allocatable **interval_last**
- real ∗8, dimension(:,:), allocatable **lid_str_last**
- real ∗8, dimension(:,:), allocatable **lid_farea**
- real ∗8, dimension(:,:), allocatable **lid_sw_add**
- real ∗8, dimension(:,:), allocatable **lid_cumqperc_last**
- real ∗8, dimension(:,:), allocatable **lid_cumirr_last**
- integer, dimension(:,:), allocatable **gr_onoff**
- integer, dimension(:,:), allocatable **gr_imo**
- integer, dimension(:,:), allocatable **gr_iyr**
- real ∗8, dimension(:,:), allocatable gr_farea

    fractional area of a green roof to the HRU (none)
- real ∗8, dimension(:,:), allocatable **gr_solop**
- real ∗8, dimension(:,:), allocatable **gr_etcoef**
- real ∗8, dimension(:,:), allocatable **gr_fc**
- real ∗8, dimension(:,:), allocatable **gr_wp**
- real ∗8, dimension(:,:), allocatable **gr_ksat**
- real ∗8, dimension(:,:), allocatable **gr_por**
- real ∗8, dimension(:,:), allocatable **gr_hydeff**
- real ∗8, dimension(:,:), allocatable **gr_soldpt**
- integer, dimension(:,:), allocatable **rg_onoff**
- integer, dimension(:,:), allocatable **rg_imo**
- integer, dimension(:,:), allocatable **rg_iyr**
- real ∗8, dimension(:,:), allocatable **rg_farea**
- real ∗8, dimension(:,:), allocatable **rg_solop**
- real ∗8, dimension(:,:), allocatable **rg_etcoef**
- real ∗8, dimension(:,:), allocatable **rg_fc**
- real ∗8, dimension(:,:), allocatable **rg_wp**
- real ∗8, dimension(:,:), allocatable **rg_ksat**
- real ∗8, dimension(:,:), allocatable **rg_por**
- real ∗8, dimension(:,:), allocatable **rg_hydeff**
- real ∗8, dimension(:,:), allocatable **rg_soldpt**
- real ∗8, dimension(:,:), allocatable **rg_dimop**
- real ∗8, dimension(:,:), allocatable **rg_sarea**
- real ∗8, dimension(:,:), allocatable **rg_vol**
- real ∗8, dimension(:,:), allocatable **rg_sth**
- real ∗8, dimension(:,:), allocatable **rg_sdia**
- real ∗8, dimension(:,:), allocatable **rg_bdia**
- real ∗8, dimension(:,:), allocatable **rg_sts**
- real ∗8, dimension(:,:), allocatable **rg_orifice**

- real ∗8, dimension(:,:), allocatable **rg_oheight**
- real ∗8, dimension(:,:), allocatable **rg_odia**
- integer, dimension(:,:), allocatable **cs_onoff**
- integer, dimension(:,:), allocatable **cs_imo**
- integer, dimension(:,:), allocatable **cs_iyr**
- integer, dimension(:,:), allocatable **cs_grcon**
- real ∗8, dimension(:,:), allocatable **cs_farea**
- real ∗8, dimension(:,:), allocatable **cs_vol**
- real ∗8, dimension(:,:), allocatable **cs_rdepth**
- integer, dimension(:,:), allocatable **pv_onoff**
- integer, dimension(:,:), allocatable **pv_imo**
- integer, dimension(:,:), allocatable **pv_iyr**
- integer, dimension(:,:), allocatable **pv_solop**
- real ∗8, dimension(:,:), allocatable **pv_grvdep**
- real ∗8, dimension(:,:), allocatable **pv_grvpor**
- real ∗8, dimension(:,:), allocatable **pv_farea**
- real ∗8, dimension(:,:), allocatable **pv_drcoef**
- real ∗8, dimension(:,:), allocatable **pv_fc**
- real ∗8, dimension(:,:), allocatable **pv_wp**
- real ∗8, dimension(:,:), allocatable **pv_ksat**
- real ∗8, dimension(:,:), allocatable **pv_por**
- real ∗8, dimension(:,:), allocatable **pv_hydeff**
- real ∗8, dimension(:,:), allocatable **pv_soldpt**
- integer, dimension(:,:), allocatable **lid_onoff**
- real ∗8, dimension(:,:), allocatable sol_hsc

  mass of C present in slow humus (kg ha-1)
- real ∗8, dimension(:,:), allocatable sol_hsn

  mass of N present in slow humus (kg ha-1)
- real ∗8, dimension(:,:), allocatable sol_hpc

  mass of C present in passive humus (kg ha-1)
- real ∗8, dimension(:,:), allocatable sol_hpn

  mass of N present in passive humus (kg ha-1)
- real ∗8, dimension(:,:), allocatable sol_lm

  mass of metabolic litter (kg ha-1)
- real ∗8, dimension(:,:), allocatable sol_lmc

  mass of C in metabolic litter (kg ha-1)
- real ∗8, dimension(:,:), allocatable sol_lmn

  mass of N in metabolic litter (kg ha-1)
- real ∗8, dimension(:,:), allocatable sol_ls

  mass of structural litter (kg ha-1)
- real ∗8, dimension(:,:), allocatable sol_lsc

  mass of C in structural litter (kg ha-1)
- real ∗8, dimension(:,:), allocatable sol_lsl

  mass of lignin in structural litter (kg ha-1)
- real ∗8, dimension(:,:), allocatable sol_lsn

  mass of N in structural litter (kg ha-1)
- real ∗8, dimension(:,:), allocatable **sol_bmc**
- real ∗8, dimension(:,:), allocatable **sol_bmn**
- real ∗8, dimension(:,:), allocatable **sol_rnmn**
- real ∗8, dimension(:,:), allocatable **sol_lslc**
- real ∗8, dimension(:,:), allocatable **sol_lslnc**
- real ∗8, dimension(:,:), allocatable **sol_rspc**
- real ∗8, dimension(:,:), allocatable **sol_woc**

- real ∗8, dimension(:,:), allocatable **sol_won**
- real ∗8, dimension(:,:), allocatable **sol_hp**
- real ∗8, dimension(:,:), allocatable **sol_hs**
- real ∗8, dimension(:,:), allocatable **sol_bm**
- real ∗8, dimension(:,:), allocatable **sol_cac**
- real ∗8, dimension(:,:), allocatable **sol_cec**
- real ∗8, dimension(:,:), allocatable **sol_percc**
- real ∗8, dimension(:,:), allocatable **sol_latc**
- real ∗8, dimension(:), allocatable sedc_d

    amount of C lost with sediment pools (kg C/ha)
- real ∗8, dimension(:), allocatable **surfqc_d**
- real ∗8, dimension(:), allocatable **latc_d**
- real ∗8, dimension(:), allocatable **percc_d**
- real ∗8, dimension(:), allocatable **foc_d**
- real ∗8, dimension(:), allocatable **nppc_d**
- real ∗8, dimension(:), allocatable **rsdc_d**
- real ∗8, dimension(:), allocatable **grainc_d**
- real ∗8, dimension(:), allocatable **stoverc_d**
- real ∗8, dimension(:), allocatable **soc_d**
- real ∗8, dimension(:), allocatable **rspc_d**
- real ∗8, dimension(:), allocatable **emitc_d**
- real ∗8, dimension(:), allocatable **sub_sedc_d**
- real ∗8, dimension(:), allocatable **sub_surfqc_d**
- real ∗8, dimension(:), allocatable **sub_latc_d**
- real ∗8, dimension(:), allocatable **sub_percc_d**
- real ∗8, dimension(:), allocatable **sub_foc_d**
- real ∗8, dimension(:), allocatable **sub_nppc_d**
- real ∗8, dimension(:), allocatable **sub_rsdc_d**
- real ∗8, dimension(:), allocatable **sub_grainc_d**
- real ∗8, dimension(:), allocatable **sub_stoverc_d**
- real ∗8, dimension(:), allocatable **sub_emitc_d**
- real ∗8, dimension(:), allocatable **sub_soc_d**
- real ∗8, dimension(:), allocatable **sub_rspc_d**
- real ∗8, dimension(:), allocatable **sedc_m**
- real ∗8, dimension(:), allocatable **surfqc_m**
- real ∗8, dimension(:), allocatable **latc_m**
- real ∗8, dimension(:), allocatable **percc_m**
- real ∗8, dimension(:), allocatable **foc_m**
- real ∗8, dimension(:), allocatable **nppc_m**
- real ∗8, dimension(:), allocatable **rsdc_m**
- real ∗8, dimension(:), allocatable **grainc_m**
- real ∗8, dimension(:), allocatable **stoverc_m**
- real ∗8, dimension(:), allocatable **emitc_m**
- real ∗8, dimension(:), allocatable **soc_m**
- real ∗8, dimension(:), allocatable **rspc_m**
- real ∗8, dimension(:), allocatable **sedc_a**
- real ∗8, dimension(:), allocatable **surfqc_a**
- real ∗8, dimension(:), allocatable **latc_a**
- real ∗8, dimension(:), allocatable **percc_a**
- real ∗8, dimension(:), allocatable **foc_a**
- real ∗8, dimension(:), allocatable **nppc_a**
- real ∗8, dimension(:), allocatable **rsdc_a**
- real ∗8, dimension(:), allocatable **grainc_a**
- real ∗8, dimension(:), allocatable **stoverc_a**

- real ∗8, dimension(:), allocatable **emitc_a**
- real ∗8, dimension(:), allocatable **soc_a**
- real ∗8, dimension(:), allocatable **rspc_a**
- integer, dimension(:), allocatable **tillage_switch**
- real ∗8, dimension(:), allocatable **tillage_depth**
- integer, dimension(:), allocatable **tillage_days**
- real ∗8, dimension(:), allocatable **tillage_factor**
- real ∗8 dthy

  time interval for subdaily flood routing
- integer, dimension(4) **ihx**
- integer, dimension(:), allocatable **nhy**
- real ∗8, dimension(:), allocatable **rchx**
- real ∗8, dimension(:), allocatable **rcss**
- real ∗8, dimension(:), allocatable **qcap**
- real ∗8, dimension(:), allocatable **chxa**
- real ∗8, dimension(:), allocatable **chxp**
- real ∗8, dimension(:,:,:), allocatable **qhy**
- real ∗8 **ff1**
- real ∗8 **ff2**

4.1.1 Detailed Description

main module containing the global variables

4.1.2 Variable Documentation

4.1.2.1 igropt

```
integer parm::igropt
```

Qual2E option for calculating the local specific growth rate of algae
1: multiplicative.

$$u = mumax\, fll\, fnn\, fpp$$

2: limiting nutrient

$$u = mumax\, fll\, \min(fnn,\, fpp)$$

3: harmonic mean

$$u = mumax\, fll\, \frac{2}{\frac{1}{fnn} + \frac{1}{fpp}}$$

Chapter 5

File Documentation

5.1 addh.f90 File Reference

Functions/Subroutines

- subroutine addh

    this subroutine adds loadings from two sources for routing

5.1.1 Detailed Description

file containing the subroutine addh

Author

modified by Javier Burguete

5.2 albedo.f90 File Reference

Functions/Subroutines

- subroutine albedo (j)

    this subroutine calculates albedo in the HRU for the day

5.2.1 Detailed Description

file containing the subroutine albedo

Author

modified by Javier Burguete

5.2.2 Function/Subroutine Documentation

5.2.2.1 albedo()

```
subroutine albedo (
            integer, intent(in) j )
```

this subroutine calculates albedo in the HRU for the day

Parameters

in	*j*	HRU number

5.3 allocate_parms.f90 File Reference

Functions/Subroutines

- subroutine allocate_parms

  this subroutine allocates array sizes

5.3.1 Detailed Description

file containing the subroutine allocate_parms

Author

modified by Javier Burguete

5.4 alph.f90 File Reference

Functions/Subroutines

- subroutine alph (iwave, j)

  this subroutine computes alpha, a dimensionless parameter that expresses the fraction of total rainfall that occurs during 0.5h

5.4.1 Detailed Description

file containing the subroutine alph

Author

modified by Javier Burguete

5.4.2 Function/Subroutine Documentation

5.4.2.1 alph()

```
subroutine alph (
            integer, intent(in) iwave,
            integer, intent(in) j )
```

this subroutine computes alpha, a dimensionless parameter that expresses the fraction of total rainfall that occurs during 0.5h

Parameters

in	*iwave*	flag to differentiate calculation of HRU and subbasin sediment calculation (none) iwave = 0 for HRU MUSLE(sedyld) each hru is calculated independently using hru area and adjusted channel length iwave = 1 subbasin # for subbasin MUSLE is computed for entire subbasin using hru weighted KLSCP
in	*j*	HRU number

5.5 anfert.f90 File Reference

Functions/Subroutines

- subroutine anfert (j)

  this subroutine automatically applies Nitrogen and Phosphorus when Nitrogen stress exceeds a user input threshhold

5.5.1 Detailed Description

file containing the subroutine anfert

Author

modified by Javier Burguete

5.5.2 Function/Subroutine Documentation

5.5.2.1 anfert()

```
subroutine anfert (
            integer, intent(in) j )
```

this subroutine automatically applies Nitrogen and Phosphorus when Nitrogen stress exceeds a user input threshhold

Parameters

in	*j*	HRU number

5.6 apply.f90 File Reference

Functions/Subroutines

- subroutine apply (j)

this subroutine applies pesticide

5.6.1 Detailed Description

file containing the subroutine apply

Author

modified by Javier Burguete

5.6.2 Function/Subroutine Documentation

5.6.2.1 apply()

```
subroutine apply (
            integer, intent(in) j )
```

this subroutine applies pesticide

Parameters

in	*j*	HRU number

5.7 ascrv.f90 File Reference

Functions/Subroutines

- subroutine ascrv (x1, x2, x3, x4, x5, x6)

  this subroutine computes shape parameters x5 and x6 for the S curve equation

5.7.1 Detailed Description

file containing the subroutine ascrv

Author

modified by Javier Burguete

5.7.2 Function/Subroutine Documentation

5.7.2.1 ascrv()

```
subroutine ascrv (
            real*8, intent(in) x1,
            real*8, intent(in) x2,
            real*8, intent(in) x3,
            real*8, intent(in) x4,
            real*8, intent(out) x5,
            real*8, intent(out) x6 )
```

this subroutine computes shape parameters x5 and x6 for the S curve equation

$$x = \frac{y}{y + \exp(x5 + x6\,y)}$$

given 2 (x,y) points along the curve. x5 is determined by solving the equation with x and y values measured around the midpoint of the curve (approx. 50% of the maximum value for x) and x6 is determined by solving the equation with x and y values measured close to one of the endpoints of the curve (100% of the maximum value for x). This subroutine is called from readbsn.f90 and readplant.f90

Parameters

in	*x1*	value for x in the above equation for first datapoint, x1 should be close to 0.5 (the midpoint of the curve)
in	*x2*	value for x in the above equation for second datapoint, x2 should be close to 0.0 or 1.0
in	*x3*	value for y in the above equation corresponding to x1
in	*x4*	value for y in the above equation corresponding to x2
out	*x5*	1st shape parameter for S curve equation characterizing the midpoint of the curve
out	*x6*	2nd shape parameter for S curve equation characterizing the regions close to the endpoints of the curve

5.8 atri.f90 File Reference

Functions/Subroutines

- real ∗8 function atri (at1, at2, at3, at4i)

  this function generates a random number from a triangular distribution given X axis points at start, end, and peak Y value

5.8.1 Detailed Description

file containing the function atri

Author

modified by Javier Burguete

5.8.2 Function/Subroutine Documentation

5.8.2.1 atri()

```
real*8 function atri (
            real*8, intent(in) at1,
            real*8, intent(in) at2,
            real*8, intent(in) at3,
            integer, intent(inout) at4i )
```

this function generates a random number from a triangular distribution given X axis points at start, end, and peak Y value

Parameters

in	*at1*	lower limit for distribution (none)
in	*at2*	monthly mean for distribution (none)
in	*at3*	upper limit for distribution (none)
in,out	*at4i*	random number seed (none)

Returns

daily value generated for distribution (none)

5.9 aunif.f90 File Reference

Functions/Subroutines

- real ∗8 function aunif (x1)

  This function generates random numbers ranging from 0.0 to 1.0. In the process of calculating the random number, the seed (x1) is set to a new value. This function implements the prime-modulus generator.

5.9.1 Detailed Description

file containing the function aunif

Author

modified by Javier Burguete

5.9.2 Function/Subroutine Documentation

5.9.2.1 aunif()

```
real*8 function aunif (
            integer, intent(inout) x1 )
```

This function generates random numbers ranging from 0.0 to 1.0. In the process of calculating the random number, the seed (x1) is set to a new value. This function implements the prime-modulus generator.

$$xi = 16807\,xi \bmod \left(2^{31} - 1\right)$$

using code which ensures that no intermediate result uses more than 31 bits. The theory behind the code is summarized in [1]

Parameters

in,out	*x1*	random number generator seed (integer) where $0 < x1 < 2147483647$

Returns

random number ranging from 0.0 to 1.0

5.10 autoirr.f90 File Reference

Functions/Subroutines

- subroutine autoirr (j)

  this subroutine performs the auto-irrigation operation

5.10.1 Detailed Description

file containing the subroutine autoirr

Author

modified by Javier Burguete

5.10.2 Function/Subroutine Documentation

5.10.2.1 autoirr()

```
subroutine autoirr (
            integer, intent(in) j )
```

this subroutine performs the auto-irrigation operation

Parameters

in	*j*	HRU number

5.11 bacteria.f90 File Reference

Functions/Subroutines

- subroutine bacteria (j)

  this subroutine calculates bacteria growth, transport with runoff and loss due to percolation into soil

5.11.1 Detailed Description

file containing the subroutine bacteria

Author

modified by Javier Burguete

5.11.2 Function/Subroutine Documentation

5.11.2.1 bacteria()

```
subroutine bacteria (
            integer, intent(in) j )
```

this subroutine calculates bacteria growth, transport with runoff and loss due to percolation into soil

Parameters

in	*j*	HRU number (none)

5.12 biozone.f90 File Reference

Functions/Subroutines

- subroutine biozone (j)

  this subroutine conducts biophysical processes occuring in the biozone layer of a septic HRU. Septic algorithm adapted from [4]

5.12.1 Detailed Description

file containing the subroutine biozone

Author

J. Jeong,
C. Santhi,
modified by Javier Burguete

5.12.2 Function/Subroutine Documentation

5.12.2.1 biozone()

```
subroutine biozone (
            integer, intent(in) j )
```

this subroutine conducts biophysical processes occuring in the biozone layer of a septic HRU. Septic algorithm adapted from [4]

Parameters

j	HRU number

5.13 bmp_ri_pond.f90 File Reference

Functions/Subroutines

- subroutine bmp_ri_pond (kk, riflw, rised)

  this subroutine routes water through a retention irrigation pond in the subbasin param[in] kk pond id number in the subbasin param[inout] riflw stormwater runoff coming in/out of pond at a time step param[inout] rised overland flow sediment coming in/out of pond at a time step

5.13.1 Detailed Description

file containing the subroutine bmp_ri_pond

Author

modified by Javier Burguete

5.14 bmp_sand_filter.f90 File Reference

Functions/Subroutines

- subroutine bmp_sand_filter (kk, flw, sed)

  this subroutine routes water and sediment through sand filters in the subbasin param[in] kk filter id number in the subbasin param[inout] flw stormwater runoff coming in/out of pond at a time step param[inout] sed overland flow sediment coming in/out of pond at a time step

5.14.1 Detailed Description

file containing the subroutine bmp_sand_filter

Author

modified by Javier Burguete

5.15 bmp_sed_pond.f90 File Reference

Functions/Subroutines

- subroutine bmp_sed_pond (kk, flw, sed)

  this subroutine routes water and sediment through a sedimentation pond in the subbasin param[in] kk filter id number in the subbasin param[inout] flw stormwater runoff coming in/out of pond at a time step param[inout] sed overland flow sediment coming in/out of pond at a time step

5.15.1 Detailed Description

file containing the subroutine bmp_sed_pond

Author

modified by Javier Burguete

5.16 bmp_wet_pond.f90 File Reference

Functions/Subroutines

- subroutine bmp_wet_pond (sb)

  run wet pond processes
- real ∗8 function **ext_dpth** (sb)
- real ∗8 function wpnd_depth (hvol, width, slp, lenwdth)

  calculate ponding depth using Newton's method
- real ∗8 function pipe_discharge (pdia, plen, hdep, mann, mloss)

  calculate discharge from extended detention through pvc pipe,m3/s

5.16.1 Detailed Description

file containing the subroutine bmp_wet_pond and the functions ext_dpth, wpnd_depth and pipe_discharge

Author

modified by Javier Burguete

5.16.2 Function/Subroutine Documentation

5.16.2.1 bmp_wet_pond()

```
subroutine bmp_wet_pond (
            integer, intent(in) sb )
```

run wet pond processes

Parameters

in	*sb*	subbasin number (none)

5.16.2.2 pipe_discharge()

```
real*8 function pipe_discharge (
            real*8, intent(in) pdia,
            real*8, intent(in) plen,
            real*8, intent(in) hdep,
            real*8, intent(in) mann,
            real*8, intent(in) mloss )
```

calculate discharge from extended detention through pvc pipe,m3/s

Parameters

out	*discharge*	(m^3/s)

5.17 bmpinit.f90 File Reference

Functions/Subroutines

- subroutine bmpinit (ii)

    this subroutine sets default values for urban bmp parameters

5.17.1 Detailed Description

file containing the subroutine bmpinit

Author

modified by Javier Burguete

5.17.2 Function/Subroutine Documentation

5.17.2.1 bmpinit()

```
subroutine bmpinit (
            integer, intent(in) ii )
```

this subroutine sets default values for urban bmp parameters

Parameters

in	*ii*	subbasin number

5.18 buffer.f90 File Reference

Functions/Subroutines

- subroutine buffer (j)

  this subroutine calculates the reduction of nitrates through a riparian buffer system - developed for Sushama at NC State

5.18.1 Detailed Description

file containing the subroutine buffer

Author

modified by Javier Burguete

5.18.2 Function/Subroutine Documentation

5.18.2.1 buffer()

```
subroutine buffer (
            integer, intent(in) j )
```

this subroutine calculates the reduction of nitrates through a riparian buffer system - developed for Sushama at NC State

Parameters

in	*j*	HRU number (none)

5.19 burnop.f90 File Reference

Functions/Subroutines

- subroutine burnop (j)

  this subroutine performs burning

5.19.1 Detailed Description

file containing the subroutine burnop

Author

modified by Javier Burguete

5.19.2 Function/Subroutine Documentation

5.19.2.1 burnop()

```
subroutine burnop (
            integer, intent(in) j )
```

this subroutine performs burning

Parameters

in	*j*	HRU number

5.20 canopyint.f90 File Reference

Functions/Subroutines

- subroutine canopyint (j)
  this subroutine computes canopy interception of rainfall used for methods other than curve number

5.20.1 Detailed Description

file containing the subroutine canopyint

Author

modified by Javier Burguete

5.20.2 Function/Subroutine Documentation

5.20.2.1 canopyint()

```
subroutine canopyint (
            integer, intent(in) j )
```

this subroutine computes canopy interception of rainfall used for methods other than curve number

Parameters

in	*j*	HRU number (none)

5.21 caps.f90 File Reference

Functions/Subroutines

- subroutine caps (file_name)

    this subroutine reads the input and output names given in file.cio and converts all capital letters to lowercase letters.

5.21.1 Detailed Description

file containing the subroutine caps

Author

modified by Javier Burguete

5.21.2 Function/Subroutine Documentation

5.21.2.1 caps()

```
subroutine caps (
            character (len=*) file_name )
```

this subroutine reads the input and output names given in file.cio and converts all capital letters to lowercase letters.

Parameters

file_name	dummy argument, file name character string

5.22 carbon_new.f90 File Reference

Functions/Subroutines

- subroutine carbon (i, j)

    This code simulates organic C, N, and P cycling in the soil. It has been adapted from [2]. and crafted to accomodate to SWAT conventions. Plant residues and manure residues are decomposed separately. For convenience, the denitrification subroutine is called from here. March 2009: testing has been minimal and further adjustments are expected. Manuscript describing this subroutine to be submitted to Ecological Modelling (September, 2010). Use with caution and report anomalous results to `akemanian@psu.edu`*,* `jeff.arnold@ars.usda.edu` *and* `stefan.julich@tudor.lu`*.*

- real *8 function **fwf** (fc, wc, pwp)
- real *8 function **fof** (void, por)
- real *8 function **ftilf** (tillage, wc, sat)
- real *8 function **fcx** (pclay)
- real *8 function **fsol_cdec** (pcarbon, cx, cfdec, tilf, csf, sol_cmass)
- real *8 function **fcnnew** (yy1, yy2, CNpool, yy5)
- real *8 function **fhc** (pclay, pcarbon, cx)
- real *8 function **fnetmin** (poold, R1, R2, hc, dummy, poolm, xinorg, cc1)

5.22.1 Detailed Description

file containing the subroutine carbon

Author

Armen R. Kemanian,
Stefan Julich,
modified by Javier Burguete

5.22.2 Function/Subroutine Documentation

5.22.2.1 carbon()

```
subroutine carbon (
            integer, intent(in) i,
            integer, intent(in) j )
```

This code simulates organic C, N, and P cycling in the soil. It has been adapted from [2]. and crafted to accomodate to SWAT conventions. Plant residues and manure residues are decomposed separately. For convenience, the denitrification subroutine is called from here. March 2009: testing has been minimal and further adjustments are expected. Manuscript describing this subroutine to be submitted to Ecological Modelling (September, 2010). Use with caution and report anomalous results to akemanian@psu.edu, jeff.arnold@ars.usda.edu and stefan.julich@tudor.lu.

Parameters

i	current day in simulation–loop counter (julian date)
j	HRU number

5.23 carbon_zhang2.f90 File Reference

Functions/Subroutines

- subroutine carbon_zhang2 (j)

5.23.1 Detailed Description

file containing the subroutine carbon_zhang2

Author

modified by Javier Burguete

5.23.2 Function/Subroutine Documentation

5.23.2.1 carbon_zhang2()

```
subroutine carbon_zhang2 (
            integer, intent(in) j )
```

Parameters

j	HRU number

5.24 cfactor.f90 File Reference

Functions/Subroutines

- subroutine cfactor (j)

  this subroutine predicts daily soil loss caused by water erosion using the modified universal soil loss equation

5.24.1 Detailed Description

file containing the subroutine cfactor

Author

modified by Javier Burguete

5.24.2 Function/Subroutine Documentation

5.24.2.1 cfactor()

```
subroutine cfactor (
            integer, intent(in) j )
```

this subroutine predicts daily soil loss caused by water erosion using the modified universal soil loss equation

Parameters

in	*j*	HRU number (none)

5.25 clgen.f90 File Reference

Functions/Subroutines

- subroutine clgen (j)

  this subroutine calculates the daylength, distribution of radiation throughout the day and maximum radiation for day

5.25.1 Detailed Description

file containing the subroutine clgen

Author

modified by Javier Burguete

5.25.2 Function/Subroutine Documentation

5.25.2.1 clgen()

```
subroutine clgen (
            integer, intent(in) j )
```

this subroutine calculates the daylength, distribution of radiation throughout the day and maximum radiation for day

Parameters

in	*j*	HRU number

5.26 clicon.f90 File Reference

Functions/Subroutines

- subroutine clicon (i)

  this subroutine controls weather inputs to SWAT. Precipitation and temperature data is read in and the weather generator is called to fill in radiation, wind speed and relative humidity as well as missing precipitation and temperatures. Adjustments for climate changes studies are also made in this subroutine.

5.26.1 Detailed Description

file containing the subroutine clicon

Author

modified by Javier Burguete

5.26.2 Function/Subroutine Documentation

5.26.2.1 clicon()

```
subroutine clicon (
            integer, intent(in) i )
```

this subroutine controls weather inputs to SWAT. Precipitation and temperature data is read in and the weather generator is called to fill in radiation, wind speed and relative humidity as well as missing precipitation and temperatures. Adjustments for climate changes studies are also made in this subroutine.

Parameters

in	*i*	current day of simulation (julian date)

5.27 command.f90 File Reference

Functions/Subroutines

- subroutine command (i)

  for every day of simulation, this subroutine steps through the command lines in the watershed configuration (.fig) file. Depending on the command code on the .fig file line, a command loop is accessed

5.27.1 Detailed Description

file containing the subroutine command

Author

modified by Javier Burguete

5.27.2 Function/Subroutine Documentation

5.27.2.1 command()

```
subroutine command (
            integer, intent(in) i )
```

for every day of simulation, this subroutine steps through the command lines in the watershed configuration (.fig) file. Depending on the command code on the .fig file line, a command loop is accessed

Parameters

in	*i*	current day in simulation–loop counter (julian date)

5.28 conapply.f90 File Reference

Functions/Subroutines

- subroutine conapply (j)
  this subroutine applies continuous pesticide

5.28.1 Detailed Description

file containing the subroutine conapply

Author

modified by Javier Burguete

5.28.2 Function/Subroutine Documentation

5.28.2.1 conapply()

```
subroutine conapply (
            integer, intent(in) j )
```

this subroutine applies continuous pesticide

Parameters

in	*h*	HRU number

5.29 confert.f90 File Reference

Functions/Subroutines

- subroutine confert (j)

  this subroutine simulates a continuous fertilizer operation

5.29.1 Detailed Description

file containing the subroutine confert

Author

modified by Javier Burguete

5.29.2 Function/Subroutine Documentation

5.29.2.1 confert()

```
subroutine confert (
            integer, intent(in) j )
```

this subroutine simulates a continuous fertilizer operation

Parameters

in	*j*	HRU number

5.30 crackflow.f90 File Reference

Functions/Subroutines

- subroutine crackflow (j)

  this surboutine modifies surface runoff to account for crack flow

5.30.1 Detailed Description

file containing the subroutine crackflow

Author

modified by Javier Burguete

5.30.2 Function/Subroutine Documentation

5.30.2.1 crackflow()

```
subroutine crackflow (
            integer, intent(in) j )
```

this surboutine modifies surface runoff to account for crack flow

Parameters

in	*j*	HRU number (none)

5.31 crackvol.f90 File Reference

Functions/Subroutines

- subroutine crackvol (j)

    this surboutine computes total crack volume for the soil profile and modifies surface runoff to account for crack flow

5.31.1 Detailed Description

file containing the subroutine crackvol

Author

modified by Javier Burguete

5.31.2 Function/Subroutine Documentation

5.31.2.1 crackvol()

```
subroutine crackvol (
            integer, intent(in) j )
```

this surboutine computes total crack volume for the soil profile and modifies surface runoff to account for crack flow

Parameters

in	*j*	HRU number (none)

5.32 curno.f90 File Reference

Functions/Subroutines

- subroutine curno (cnn, h)

  this subroutine determines the curve numbers for moisture conditions I and III and calculates coefficents and shape parameters for the water retention curve. The coefficents and shape parameters are calculated by one of two methods:
  the default method is to make them a function of soil water,
  the alternative method (labeled new) is to make them a function of accumulated PET, precipitation and surface runoff

5.32.1 Detailed Description

file containing the subroutine curno

Author

modified by Javier Burguete

5.32.2 Function/Subroutine Documentation

5.32.2.1 curno()

```
subroutine curno (
            real*8, intent(in) cnn,
            integer, intent(in) h )
```

this subroutine determines the curve numbers for moisture conditions I and III and calculates coefficents and shape parameters for the water retention curve. The coefficents and shape parameters are calculated by one of two methods:
the default method is to make them a function of soil water,
the alternative method (labeled new) is to make them a function of accumulated PET, precipitation and surface runoff

Parameters

in	*cnn*	SCS runoff curve number for moisture condition II
in	*h*	HRU number

5.33 dailycn.f90 File Reference

Functions/Subroutines

- subroutine dailycn (j)

  calculates curve number for the day in the HRU

5.33.1 Detailed Description

file containing the subroutine dailycn

Author

modified by Javier Burguete

5.33.2 Function/Subroutine Documentation

5.33.2.1 dailycn()

```
subroutine dailycn (
            integer, intent(in) j )
```

calculates curve number for the day in the HRU

Parameters

in	*j*	HRU number (none)

5.34 decay.f90 File Reference

Functions/Subroutines

- subroutine decay (j)
  this subroutine calculates degradation of pesticide in the soil and on the plants

5.34.1 Detailed Description

file containing the subroutine decay

Author

modified by Javier Burguete

5.34.2 Function/Subroutine Documentation

5.34.2.1 decay()

```
subroutine decay (
            integer, intent(in) j )
```

this subroutine calculates degradation of pesticide in the soil and on the plants

Parameters

in	*j*	HRU number

5.35 depstor.f90 File Reference

Functions/Subroutines

- subroutine depstor (j)

  this subroutine computes maximum surface depressional storage depth based on random and oriented roughness and slope steepness

5.35.1 Detailed Description

file containing the subroutine depstor

Author

modified by Javier Burguete

5.35.2 Function/Subroutine Documentation

5.35.2.1 depstor()

```
subroutine depstor (
            integer, intent(in) j )
```

this subroutine computes maximum surface depressional storage depth based on random and oriented roughness and slope steepness

Parameters

in	*j*	HRU number

5.36 distributed_bmps.f90 File Reference

Functions/Subroutines

- subroutine distributed_bmps

  this subroutine calls routines for urban BMPs in the subbasin

5.36.1 Detailed Description

file containing the subroutine distributed_bmps

Author

modified by Javier Burguete

5.37 dormant.f90 File Reference

Functions/Subroutines

- subroutine dormant (j)

  this subroutine checks the dormant status of the different plant types

5.37.1 Detailed Description

file containing the subroutine dormant

Author

modified by Javier Burguete

5.37.2 Function/Subroutine Documentation

5.37.2.1 dormant()

```
subroutine dormant (
            integer, intent(in) j )
```

this subroutine checks the dormant status of the different plant types

Parameters

in	*j*	HRU number

5.38 drains.f90 File Reference

Functions/Subroutines

- subroutine drains (j)

  this subroutine finds the effective lateral hydraulic conductivity and computes drainage or subirrigation flux

5.38.1 Detailed Description

file containing the subroutine drains

Author

modified by Javier Burguete

5.38.2 Function/Subroutine Documentation

5.38.2.1 drains()

```
subroutine drains (
            integer, intent(in) j )
```

this subroutine finds the effective lateral hydraulic conductivity and computes drainage or subirrigation flux

Parameters

in	*j*	HRU number

5.39 dstn1.f90 File Reference

Functions/Subroutines

- real ∗8 function dstn1 (rn1, rn2)

  this function computes the distance from the mean of a normal distribution with mean = 0 and standard deviation = 1, given two random numbers

5.39.1 Detailed Description

file containing the function dstn1

Author

modified by Javier Burguete

5.39.2 Function/Subroutine Documentation

5.39.2.1 dstn1()

```
real*8 function dstn1 (
            real*8, intent(in) rn1,
            real*8, intent(in) rn2 )
```

this function computes the distance from the mean of a normal distribution with mean = 0 and standard deviation = 1, given two random numbers

Parameters

in	*rn1*	first random number
in	*rn2*	second random number

Returns

distance from the mean

5.40 ee.f90 File Reference

Functions/Subroutines

- real ∗8 function ee (tk)

    this function calculates saturation vapor pressure at a given air temperature

5.40.1 Detailed Description

file containing the function ee

Author

modified by Javier Burguete

5.40.2 Function/Subroutine Documentation

5.40.2.1 ee()

```
real*8 function ee (
            real*8, intent(in) tk )
```

this function calculates saturation vapor pressure at a given air temperature

Parameters

in	*tk*	mean air temperature (deg C)

Returns

saturation vapor pressure (kPa)

5.41 eiusle.f90 File Reference

Functions/Subroutines

- subroutine eiusle (j)
  this subroutine computes the USLE erosion index (EI)

5.41.1 Detailed Description

file containing the subroutine eiusle

Author

modified by Javier Burguete

5.42 enrsb.f90 File Reference

Functions/Subroutines

- subroutine enrsb (iwave, j)
  this subroutine calculates the enrichment ratio for nutrient and pesticide transport with runoff

5.42.1 Detailed Description

file containing the subroutine enrsb

Author

modified by Javier Burguete

5.42.2 Function/Subroutine Documentation

5.42.2.1 enrsb()

```
subroutine enrsb (
            integer, intent(in) iwave,
            integer, intent(in) j )
```

this subroutine calculates the enrichment ratio for nutrient and pesticide transport with runoff

Parameters

in	*iwave*	flag to differentiate calculation of HRU and subbasin sediment calculation (none) iwave = 0 for HRU iwave = subbasin # for subbasin
in	*j*	HRU number

5.43 estimate_ksat.f90 File Reference

Functions/Subroutines

- subroutine estimate_ksat (perc_clay, esti_ksat)

  This subroutine calculates ksat value for a soil layer given the % of clay in the soil layer.

5.43.1 Detailed Description

file containing the subroutine estimate_ksat

Author

modified by Javier Burguete

5.43.2 Function/Subroutine Documentation

5.43.2.1 estimate_ksat()

```
subroutine estimate_ksat (
            real*8, intent(in) perc_clay,
            real*8, intent(out) esti_ksat )
```

This subroutine calculates ksat value for a soil layer given the % of clay in the soil layer.

Background: published work of Walter Rawls. Calculated ksat values based on soil texture (sand, silt and clay). Idea: there exists a relationship between % clay and Ksat. Equations used in this subroutine are based on the above idea (Jimmy Willimas)

Parameters

in	*perc_clay*	clay percentage (%)
out	*esti_ksat*	estimated ksat

5.44 etact.f90 File Reference

Functions/Subroutines

- subroutine etact (j)

  this subroutine calculates potential plant transpiration for Priestley- Taylor and Hargreaves ET methods, and potential and actual soil evaporation. NO3 movement into surface soil layer due to evaporation is also calculated.

5.44.1 Detailed Description

file containing the subroutine etact

Author

modified by Javier Burguete

5.45 etpot.f90 File Reference

Functions/Subroutines

- subroutine etpot (j)

  this subroutine calculates potential evapotranspiration using one of three methods. If Penman-Monteith is being used, potential plant transpiration is also calculated.

5.45.1 Detailed Description

file containing the subroutine etpot

Author

modified by Javier Burguete

5.45.2 Function/Subroutine Documentation

5.45.2.1 etpot()

```
subroutine etpot (
            integer, intent(in) j )
```

this subroutine calculates potential evapotranspiration using one of three methods. If Penman-Monteith is being used, potential plant transpiration is also calculated.

Parameters

in	*j*	HRU number

5.46 expo.f90 File Reference

Functions/Subroutines

- real ∗8 function expo (xx)

    this function checks the argument against upper and lower boundary values prior to taking the Exponential

5.46.1 Detailed Description

file containing the function expo

Author

modified by Javier Burguete

5.46.2 Function/Subroutine Documentation

5.46.2.1 expo()

```
real*8 function expo (
            real*8, intent(in) xx )
```

this function checks the argument against upper and lower boundary values prior to taking the Exponential

Parameters

in	*xx*	exponential argument (none)

Returns

$\exp(xx)$

5.47 fcgd.f90 File Reference

Functions/Subroutines

- real ∗8 function **fcgd** (xx)

5.47.1 Detailed Description

file containing the function fcgd

Author

modified by Javier Burguete

5.48 fert.f90 File Reference

Functions/Subroutines

- subroutine fert (j)

  this subroutine applies N and P specified by date and amount in the management file (.mgt)

5.48.1 Detailed Description

file containing the subroutine fert

Author

modified by Javier Burguete

5.48.2 Function/Subroutine Documentation

5.48.2.1 fert()

```
subroutine fert (
            integer, intent(in) j )
```

this subroutine applies N and P specified by date and amount in the management file (.mgt)

Parameters

in	*j*	HRU number

5.49 filter.f90 File Reference

Functions/Subroutines

- subroutine filter (i, j)

  this subroutine calculates the reduction of pollutants in surface runoff due to an edge of field filter or buffer strip

5.49.1 Detailed Description

file containing the subroutine filter

Author

modified by Javier Burguete

5.49.2 Function/Subroutine Documentation

5.49.2.1 filter()

```
subroutine filter (
            integer, intent(in) i,
            integer, intent(in) j )
```

this subroutine calculates the reduction of pollutants in surface runoff due to an edge of field filter or buffer strip

Parameters

in	*i*	current day in simulation–loop counter (julian date)
in	*j*	HRU number (none)

5.50 filtw.f90 File Reference

Functions/Subroutines

- subroutine filtw (j)

  this subroutine calculates the reduction of pollutants in surface runoff due to an edge of field filter or buffer strip

5.50.1 Detailed Description

file containing the subroutine filtw

Author

modified by Javier Burguete

5.50.2 Function/Subroutine Documentation

5.50.2.1 filtw()

```
subroutine filtw (
            integer, intent(in) j )
```

this subroutine calculates the reduction of pollutants in surface runoff due to an edge of field filter or buffer strip

Parameters

in	*j*	HRU number (none)

5.51 finalbal.f90 File Reference

Functions/Subroutines

- subroutine finalbal

  this subroutine calculates final water balance for watershed

5.51.1 Detailed Description

file containing the subroutine finalbal

Author

modified by Javier Burguete

5.52 gcycl.f90 File Reference

Functions/Subroutines

- subroutine gcycl

  This subroutine initializes the random number seeds. If the user desires a different set of random numbers for each simulation run, the random number generator is used to reset the values of the seeds.

5.52.1 Detailed Description

file containing the subroutine gcycl

Author

modified by Javier Burguete

5.53 getallo.f90 File Reference

Functions/Subroutines

- subroutine getallo

  This subroutine calculates the number of HRUs, subbasins, etc. in the simulation. These values are used to allocate array sizes.

5.53.1 Detailed Description

file containing the subroutine getallo

Author

modified by Javier Burguete

5.54 grass_wway.f90 File Reference

Functions/Subroutines

- subroutine grass_wway (j)
  this subroutine controls the grass waterways

5.54.1 Detailed Description

file containing the subroutine grass_wway

Author

modified by Javier Burguete

5.54.2 Function/Subroutine Documentation

5.54.2.1 grass_wway()

```
subroutine grass_wway (
            integer, intent(in) j )
```

this subroutine controls the grass waterways

Parameters

in	*j*	HRU number (none)

5.55 graze.f90 File Reference

Functions/Subroutines

- subroutine graze (j)
  this subroutine simulates biomass lost to grazing

5.55.1 Detailed Description

file containing the subroutine graze

Author

modified by Javier Burguete

5.55.2 Function/Subroutine Documentation

5.55.2.1 graze()

```
subroutine graze (
            integer, intent(in) j )
```

this subroutine simulates biomass lost to grazing

Parameters

in	*j*	HRU number

5.56 grow.f90 File Reference

Functions/Subroutines

- subroutine grow (j)

    this subroutine adjusts plant biomass, leaf area index, and canopy height taking into account the effect of water, temperature and nutrient stresses on the plant

5.56.1 Detailed Description

file containing the subroutine grow

Author

modified by Javier Burguete

5.56.2 Function/Subroutine Documentation

5.56.2.1 grow()

```
subroutine grow (
            integer, intent(in) j )
```

this subroutine adjusts plant biomass, leaf area index, and canopy height taking into account the effect of water, temperature and nutrient stresses on the plant

Parameters

in	*j*	HRU number

5.57 gw_no3.f90 File Reference

Functions/Subroutines

- subroutine gw_no3 (j)

    this subroutine estimates groundwater contribution to streamflow

5.57.1 Detailed Description

file containing the subroutine gw_no3

Author

modified by Javier Burguete

5.57.2 Function/Subroutine Documentation

5.57.2.1 gw_no3()

```
subroutine gw_no3 (
            integer, intent(in) j )
```

this subroutine estimates groundwater contribution to streamflow

Parameters

in	*j*	HRU number (none)

5.58 gwmod.f90 File Reference

Functions/Subroutines

- subroutine gwmod (j)

    this subroutine estimates groundwater contribution to streamflow

5.58.1 Detailed Description

file containing the subroutine gwmod

Author

modified by Javier Burguete

5.58.2 Function/Subroutine Documentation

5.58.2.1 gwmod()

```
subroutine gwmod (
            integer, intent(in) j )
```

this subroutine estimates groundwater contribution to streamflow

Parameters

j	HRU number

5.59 gwmod_deep.f90 File Reference

Functions/Subroutines

- subroutine gwmod_deep (j)
  this subroutine estimates groundwater contribution to streamflow

5.59.1 Detailed Description

file containing the subroutine gwmod_deep

Author

modified by Javier Burguete

5.59.2 Function/Subroutine Documentation

5.59.2.1 gwmod_deep()

```
subroutine gwmod_deep (
            integer, intent(in) j )
```

this subroutine estimates groundwater contribution to streamflow

Parameters

j	HRU number

5.60 gwnutr.f90 File Reference

Functions/Subroutines

- subroutine gwnutr (j)

  this subroutine calculates the nitrate and soluble phosphorus loading contributed by groundwater flow

5.60.1 Detailed Description

file containing the subroutine gwnutr

Author

modified by Javier Burguete

5.60.2 Function/Subroutine Documentation

5.60.2.1 gwnutr()

```
subroutine gwnutr (
            integer, intent(in) j )
```

this subroutine calculates the nitrate and soluble phosphorus loading contributed by groundwater flow

Parameters

in	*j*	HRU number (none)

5.61 h2omgt_init.f90 File Reference

Functions/Subroutines

- subroutine h2omgt_init

  This subroutine initializes variables related to water management (irrigation, consumptive water use, etc.)

5.61.1 Detailed Description

file containing the subroutine h2omgt_init

Author

modified by Javier Burguete

5.62 harvestop.f90 File Reference

Functions/Subroutines

- subroutine harvestop (j)
  this subroutine performs the harvest operation (no kill)

5.62.1 Detailed Description

file containing the subroutine harvestop

Author

modified by Javier Burguete

5.62.2 Function/Subroutine Documentation

5.62.2.1 harvestop()

```
subroutine harvestop (
            integer, intent(in) j )
```

this subroutine performs the harvest operation (no kill)

Parameters

in	*j*	HRU number

5.63 harvkillop.f90 File Reference

Functions/Subroutines

- subroutine harvkillop (j)
  this subroutine performs the harvest and kill operation

5.63.1 Detailed Description

file containing the subroutine harvkillop

Author

modified by Javier Burguete

5.63.2 Function/Subroutine Documentation

5.63.2.1 harvkillop()

```
subroutine harvkillop (
            integer, intent(in) j )
```

this subroutine performs the harvest and kill operation

Parameters

in	*j*	HRU number

5.64 headout.f90 File Reference

Functions/Subroutines

- subroutine headout

  this subroutine writes the headings to the major output files

5.64.1 Detailed Description

file containing the subroutine headout

Author

modified by Javier Burguete

5.65 hhnoqual.f90 File Reference

Functions/Subroutines

- subroutine hhnoqual (jrch)

  this subroutine performs in-stream nutrient calculations. No transformations are calculated

5.65.1 Detailed Description

file containing the subroutine hhnoqual

Author

modified by Javier Burguete

5.65.2 Function/Subroutine Documentation

5.65.2.1 hhnoqual()

```
subroutine hhnoqual (
            integer, intent(in) jrch )
```

this subroutine performs in-stream nutrient calculations. No transformations are calculated

Parameters

in	*jrch*	reach number (none)

5.66 hhwatqual.f90 File Reference

Functions/Subroutines

- subroutine hhwatqual (jrch)
  this subroutine performs in-stream nutrient transformations and water quality calculations for hourly timestep

5.66.1 Detailed Description

file containing the subroutine hhwatqual

Author

modified by Javier Burguete

5.66.2 Function/Subroutine Documentation

5.66.2.1 hhwatqual()

```
subroutine hhwatqual (
            integer, intent(in) jrch )
```

this subroutine performs in-stream nutrient transformations and water quality calculations for hourly timestep

Parameters

in	*jrch*	reach number (none)

5.67 hmeas.f90 File Reference

Functions/Subroutines

- subroutine hmeas

    this subroutine reads in relative humidity data from file and assigns the data to the HRUs

5.67.1 Detailed Description

file containing the subroutine hmeas

Author

modified by Javier Burguete

5.68 HQDAV.f90 File Reference

Functions/Subroutines

- subroutine hqdav (A, CBW, QQ, SSS, ZCH, ZX, CHW, FPW, jrch)

    this subprogram computes flow area and depth given rate in a reach. Adopted from APEX1501 by Jaehak Jeong 2017

5.68.1 Detailed Description

file containing the subroutine HQDAV

Author

Jaehak Jeong,
modified by Javier Burguete

5.69 hruaa.f90 File Reference

Functions/Subroutines

- subroutine hruaa (years)

    this subroutine writes average annual HRU output to the output.hru file

5.69.1 Detailed Description

file containing the subroutine hruaa

Author

modified by Javier Burguete

5.69.2 Function/Subroutine Documentation

5.69.2.1 hruaa()

```
subroutine hruaa (
            real*8, intent(in) years )
```

this subroutine writes average annual HRU output to the output.hru file

Parameters

in	*years*	length of simulation (years)

5.70 hruallo.f90 File Reference

Functions/Subroutines

- subroutine hruallo

  This subroutine calculates the number of management operation types, etc. used in the simulation. These values are used to allocate array sizes for processes occurring in the HRU.

5.70.1 Detailed Description

file containing the subroutine hruallo

Author

modified by Javier Burguete

5.71 hruday.f90 File Reference

Functions/Subroutines

- subroutine hruday (i, j)

  this subroutine writes daily HRU output to the output.hru file

5.71.1 Detailed Description

file containing the subroutine hruday

Author

modified by Javier Burguete

5.71.2 Function/Subroutine Documentation

5.71.2.1 hruday()

```
subroutine hruday (
            integer, intent(in) i,
            integer, intent(in) j )
```

this subroutine writes daily HRU output to the output.hru file

Parameters

in	*i*	current day in simulation–loop counter (julian date)
in	*j*	HRU number (none)

5.72 hrumon.f90 File Reference

Functions/Subroutines

- subroutine hrumon

  this subroutine writes monthly HRU output to the output.hru file

5.72.1 Detailed Description

file containing the subroutine hrumon

Author

modified by Javier Burguete

5.73 hrupond.f90 File Reference

Functions/Subroutines

- subroutine hrupond (j)

  this subroutine routes water and sediment through ponds in the HRUs

5.73.1 Detailed Description

file containing the subroutine hrupond

Author

modified by Javier Burguete

5.73.2 Function/Subroutine Documentation

5.73.2.1 hrupond()

```
subroutine hrupond (
            integer, intent(in) j )
```

this subroutine routes water and sediment through ponds in the HRUs

Parameters

in	*j*	HRU number (none)

5.74 hrupondhr.f90 File Reference

Functions/Subroutines

- subroutine hrupondhr (j)
  this subroutine routes water and sediment through ponds in the HRUs in a subdaily time step

5.74.1 Detailed Description

file containing the subroutine hrupondhr

Author

modified by Javier Burguete

5.74.2 Function/Subroutine Documentation

5.74.2.1 hrupondhr()

```
subroutine hrupondhr (
            integer, intent(in) j )
```

this subroutine routes water and sediment through ponds in the HRUs in a subdaily time step

Parameters

in	*j*	HRU number (none)

5.75 hruyr.f90 File Reference

Functions/Subroutines

- subroutine hruyr

  this subroutine writes annual HRU output to the output.hru file

5.75.1 Detailed Description

file containing the subroutine hruyr

Author

modified by Javier Burguete

5.76 hydroinit.f90 File Reference

Functions/Subroutines

- subroutine hydroinit

  This subroutine computes variables related to the watershed hydrology: the time of concentration for the subbasins, lagged surface runoff, the coefficient for the peak runoff rate equation, and lateral flow travel time.

5.76.1 Detailed Description

file containing the subroutine hydroinit

Author

modified by Javier Burguete

5.77 icl.f90 File Reference

Functions/Subroutines

- integer function icl (id)

  this function determines the month and day, given the julian date

5.77.1 Detailed Description

file containing the function icl

Author

modified by Javier Burguete

5.77.2 Function/Subroutine Documentation

5.77.2.1 icl()

```
integer function icl (
            integer, intent(in) id )
```

this function determines the month and day, given the julian date

Parameters

in	*id*	julian date

5.78 impnd_init.f90 File Reference

Functions/Subroutines

- subroutine impnd_init

  this subroutine initializes variables related to impoundments (ponds, wetlands, reservoirs and potholes)

5.78.1 Detailed Description

file containing the subroutine impnd_init

Author

modified by Javier Burguete

5.79 impndday.f90 File Reference

Functions/Subroutines

- subroutine impndday (j)

  this subroutine writes daily HRU output to the output.wtr file

5.79.1 Detailed Description

file containing the subroutine impndday

Author

modified by Javier Burguete

5.79.2 Function/Subroutine Documentation

5.79.2.1 impndday()

```
subroutine impndday (
            integer, intent(in) j )
```

this subroutine writes daily HRU output to the output.wtr file

Parameters

in	*j*	HRU number (none)

5.80 impndmon.f90 File Reference

Functions/Subroutines

- subroutine impndmon

  this subroutine writes monthly HRU impoundment output to the output.wtr file

5.80.1 Detailed Description

file containing the subroutine impndmon

Author

modified by Javier Burguete

5.81 impndyr.f90 File Reference

Functions/Subroutines

- subroutine impndyr

  this subroutine writes annual HRU impondment output to the output.wtr file

5.81.1 Detailed Description

file containing the subroutine impndyr

Author

modified by Javier Burguete

5.82 irr_rch.f90 File Reference

Functions/Subroutines

- subroutine irr_rch (jrch)

  this subroutine performs the irrigation operation when the water source is a reach

5.82.1 Detailed Description

file containing the subroutine irr_rch

Author

modified by Javier Burguete

5.82.2 Function/Subroutine Documentation

5.82.2.1 irr_rch()

```
subroutine irr_rch (
            integer, intent(in) jrch )
```

this subroutine performs the irrigation operation when the water source is a reach

Parameters

in	*jrch*	reach number (none)

5.83 irrigate.f90 File Reference

Functions/Subroutines

- subroutine irrigate (j, volmm)

  this subroutine applies irrigation water to HRU

5.83.1 Detailed Description

file containing the subroutine irrigate

Author

modified by Javier Burguete

5.83.2 Function/Subroutine Documentation

5.83.2.1 irrigate()

```
subroutine irrigate (
            integer, intent(in) j,
            real*8, intent(in) volmm )
```

this subroutine applies irrigation water to HRU

Parameters

in	*j*	HRU number (none)
in	*volmm*	depth irrigation water applied to HRU (mm H2O)

5.84 irrsub.f90 File Reference

Functions/Subroutines

- subroutine irrsub (j)

  this subroutine performs the irrigation operation when the source is the shallow or deep aquifer or a source outside the watershed

5.84.1 Detailed Description

file containing the subroutine irrsub

Author

modified by Javier Burguete

5.84.2 Function/Subroutine Documentation

5.84.2.1 irrsub()

```
subroutine irrsub (
            integer, intent(in) j )
```

this subroutine performs the irrigation operation when the source is the shallow or deep aquifer or a source outside the watershed

Parameters

in	*j*	HRU number (none)

5.85 jdt.f90 File Reference

Functions/Subroutines

- integer function jdt (numdays, i, m)
  this function computes the julian date given the month and the day of the month

5.85.1 Detailed Description

file containing the function jdt

Author

modified by Javier Burguete

5.85.2 Function/Subroutine Documentation

5.85.2.1 jdt()

```
integer function jdt (
            integer, dimension (13), intent(in) numdays,
            integer, intent(in) i,
            integer, intent(in) m )
```

this function computes the julian date given the month and the day of the month

Parameters

in	*numdays*	julian date for last day of preceding month (where the array location is the number of the month). The dates are for leap years (numdays=ndays) (julian date)
in	*i*	day
in	*m*	month

5.86 killop.f90 File Reference

Functions/Subroutines

- subroutine killop (j)

  this subroutine performs the kill operation

5.86.1 Detailed Description

file containing the subroutine killop

Author

modified by Javier Burguete

5.86.2 Function/Subroutine Documentation

5.86.2.1 killop()

```
subroutine killop (
            integer, intent(in) j )
```

this subroutine performs the kill operation

Parameters

in	*j*	HRU number

5.87 latsed.f90 File Reference

Functions/Subroutines

- subroutine latsed (j)

  this subroutine calculates the sediment load contributed in lateral flow

5.87.1 Detailed Description

file containing the subroutine latsed

Author

modified by Javier Burguete

5.87.2 Function/Subroutine Documentation

5.87.2.1 latsed()

```
subroutine latsed (
            integer, intent(in) j )
```

this subroutine calculates the sediment load contributed in lateral flow

Parameters

in	*j*	HRU number (none)

5.88 lid_cistern.f90 File Reference

Functions/Subroutines

- subroutine lid_cistern (sb, j, k, lid_prec)

  simulate cistern processes

5.88.1 Detailed Description

file containing the subroutine lid_cistern

Author

modified by Javier Burguete

5.88.2 Function/Subroutine Documentation

5.88.2.1 lid_cistern()

```
subroutine lid_cistern (
            integer, intent(in) sb,
            integer, intent(in) j,
            integer, intent(in) k,
            real*8, intent(in) lid_prec )
```

simulate cistern processes

Parameters

in	*sb*	subbasin number (none)
in	*j*	HRU number (none)
in	*k*	subdaily time index (none)
in	*lid_prec*	precipitation depth a LID receives in a simulation time interval (mm)

5.89 lid_greenroof.f90 File Reference

Functions/Subroutines

- subroutine lid_greenroof (sb, j, k, lid_prec)
  simulate green roof processes

5.89.1 Detailed Description

file containing the subroutine lid_greenroof

Author

modified by Javier Burguete

5.89.2 Function/Subroutine Documentation

5.89.2.1 lid_greenroof()

```
subroutine lid_greenroof (
            integer, intent(in) sb,
            integer, intent(in) j,
            integer, intent(in) k,
            real*8, intent(in) lid_prec )
```

simulate green roof processes

Parameters

in	*sb*	subbasin number (none)
in	*j*	HRU number (none)
in	*k*	subdaily time index (none)
in	*lid_prec*	precipitation depth a LID receives in a simulation time interval (mm)

5.90 lid_porpavement.f90 File Reference

Functions/Subroutines

- subroutine lid_porpavement (sb, j, k, lid_prec)

  simulate porous pavement processes

5.90.1 Detailed Description

file containing the subroutine lid_porpavement

Author

modified by Javier Burguete

5.90.2 Function/Subroutine Documentation

5.90.2.1 lid_porpavement()

```
subroutine lid_porpavement (
            integer, intent(in) sb,
            integer, intent(in) j,
            integer, intent(in) k,
            real*8, intent(in) lid_prec )
```

simulate porous pavement processes

Parameters

in	*sb*	subbasin number (none)
in	*j*	HRU number (none)
in	*k*	subdaily time index (none)
in	*lid_prec*	precipitation depth a LID receives in a simulation time interval (mm)

5.91 lid_raingarden.f90 File Reference

Functions/Subroutines

- subroutine lid_raingarden (sb, j, k, lid_prec)

  simulate rain garden processes

5.91.1 Detailed Description

file containing the subroutine lid_raingarden

Author

modified by Javier Burguete

5.91.2 Function/Subroutine Documentation

5.91.2.1 lid_raingarden()

```
subroutine lid_raingarden (
            integer, intent(in) sb,
            integer, intent(in) j,
            integer, intent(in) k,
            real*8, intent(in) lid_prec )
```

simulate rain garden processes

Parameters

in	*sb*	subbasin number (none)
in	*j*	HRU number (none)
in	*k*	subdaily time index (none)
in	*lid_prec*	precipitation depth a LID receives in a simulation time interval (mm)

5.92 lidinit.f90 File Reference

Functions/Subroutines

- subroutine lidinit (i)

  this subroutine sets default values for LID parameters

5.92.1 Detailed Description

file containing the subroutine lidinit

Author

modified by Javier Burguete

5.92.2 Function/Subroutine Documentation

5.92.2.1 lidinit()

```
subroutine lidinit (
            integer, intent(in) i )
```

this subroutine sets default values for LID parameters

Parameters

in	*i*	subbasin number

5.93 lids.f90 File Reference

Functions/Subroutines

- subroutine lids (sb, j, k, lid_prec)
  call subroutines to simulate green roof, rain garden, cistern and porous pavement processes

5.93.1 Detailed Description

file containing the subroutine lids

Author

modified by Javier Burguete

5.93.2 Function/Subroutine Documentation

5.93.2.1 lids()

```
subroutine lids (
            integer, intent(in) sb,
            integer, intent(in) j,
            integer, intent(in) k,
            real*8, intent(in) lid_prec )
```

call subroutines to simulate green roof, rain garden, cistern and porous pavement processes

Parameters

in	*sb*	subbasin number (none)
in	*j*	HRU number (none)
in	*k*	subdaily time index (none)
in	*lid_prec*	precipitation depth a LID receives in a simulation time interval (mm)

5.94 log_normal.f90 File Reference

Functions/Subroutines

- real ∗8 function log_normal (mu, sig)

  this function generates a random number from a lognormal distribution curve for estimating constituent concentration in the effluent of urban bmps given mean and standard deviation values. Jaehak Jeong, 2017

5.94.1 Detailed Description

file containing the function log_normal

Author

modified by Javier Burguete

5.94.2 Function/Subroutine Documentation

5.94.2.1 log_normal()

```
real*8 function log_normal (
            real*8, intent(in) mu,
            real*8, intent(in) sig )
```

this function generates a random number from a lognormal distribution curve for estimating constituent concentration in the effluent of urban bmps given mean and standard deviation values. Jaehak Jeong, 2017

Parameters

in	*mu*	mean value
in	*standard*	deviation

Returns

value generated for distribution

5.95 lwqdef.f90 File Reference

Functions/Subroutines

- subroutine lwqdef (ii)

  this subroutine assigns default values for the lake water quality (.lwq) when the lake water quality file does not exists

5.95.1 Detailed Description

file containing the subroutine lwqdef

Author

modified by Javier Burguete

5.95.2 Function/Subroutine Documentation

5.95.2.1 lwqdef()

```
subroutine lwqdef (
            integer, intent(in) ii )
```

this subroutine assigns default values for the lake water quality (.lwq) when the lake water quality file does not exists

Parameters

in	*ii*	reservoir number (none)

5.96 main.f90 File Reference

Functions/Subroutines

- program main

  this is the main program that reads input, calls the main simulation model, and writes output

5.96.1 Detailed Description

file containing the main program that reads input, calls the main simulation model, and writes output.

Author

modified by Javier Burguete Tolosa

5.97 modparm.f90 File Reference

Modules

- module parm

  main module containing the global variables

Variables

- integer, parameter parm::mvaro = 33

  max number of variables routed through the reach
- integer, parameter parm::mhruo = 79

  maximum number of variables written to HRU output file (output.hru) (none)
- integer, parameter parm::mrcho = 62

  maximum number of variables written to reach output file (.rch) (none)
- integer, parameter parm::msubo = 24

  maximum number of variables written to subbasin output file (output.sub) (none)
- integer, parameter parm::mstdo = 113

  max number of variables summarized in output.std
- integer, parameter **parm::motot** = 600
- character(len=80), parameter parm::prog = "SWAT Sep 7 VER 2018/Rev 670"

  SWAT program header string (name and version)
- character(len=13), dimension(mhruo), parameter parm::heds = (/" PRECIPmm"," SNOFALLmm"," SNOM↩ELTmm"," IRRmm"," PETmm"," ETmm"," SW_INITmm"," SW_ENDmm"," PERCmm"," GW_RCHGmm"," DA_RCHGmm"," REVAPmm"," SA_IRRmm"," DA_IRRmm"," SA_STmm"," DA_STmm","SURQ_GE↩Nmm","SURQ_CNTmm"," TLOSSmm"," LATQGENmm"," GW_Qmm"," WYLDmm"," DAILYCN"," TMP↩_AVdgC"," TMP_MXdgC"," TMP_MNdgC","SOL_TMPdgC","SOLARMJ/m2"," SYLDt/ha"," USLEt/ha","N_↩APPkg/ha","P_APPkg/ha","NAUTOkg/ha","PAUTOkg/ha"," NGRZkg/ha"," PGRZkg/ha","NCFRTkg/ha","P↩CFRTkg/ha","NRAINkg/ha"," NFIXkg/ha"," F-MNkg/ha"," A-MNkg/ha"," A-SNkg/ha"," F-MPkg/ha","AO-L↩Pkg/ha"," L-APkg/ha"," A-SPkg/ha"," DNITkg/ha"," NUPkg/ha"," PUPkg/ha"," ORGNkg/ha"," ORGPkg/ha"," SEDPkg/ha","NSURQkg/ha","NLATQkg/ha"," NO3Lkg/ha","NO3GWkg/ha"," SOLPkg/ha"," P_GWkg/ha"," W_STRS"," TMP_STRS"," N_STRS"," P_STRS"," BIOMt/ha"," LAI"," YLDt/ha"," BACTPct "," BACTL↩Pct"," WTAB CLIm"," WTAB SOLm"," SNOmm"," CMUPkg/ha","CMTOTkg/ha"," QTILEmm"," TNO3kg/ha"," LNO3kg/ha"," GW_Q_Dmm"," LATQCNTmm"," TVAPkg/ha"/)

  column headers for HRU output file
- character(len=13), dimension(msubo), parameter parm::hedb = (/" PRECIPmm"," SNOMELTmm"," P↩ETmm"," ETmm"," SWmm"," PERCmm"," SURQmm"," GW_Qmm"," WYLDmm"," SYLDt/ha"," ORG↩Nkg/ha"," ORGPkg/ha","NSURQkg/ha"," SOLPkg/ha"," SEDPkg/ha"," LAT Q(mm)","LATNO3kg/h","GWN↩O3kg/ha","CHOLAmic/L","CBODU mg/L"," DOXQ mg/L"," TNO3kg/ha"," QTILEmm"," TVAPkg/ha"/)

  column headers for subbasin output file
- character(len=13), dimension(mrcho), parameter parm::hedr = (/" FLOW_INcms"," FLOW_OUTcms"," EVAPcms"," TLOSScms"," SED_INtons"," SED_OUTtons"," SEDCONCmg/L"," ORGN_INkg"," ORG↩N_OUTkg"," ORGP_INkg"," ORGP_OUTkg"," NO3_INkg"," NO3_OUTkg"," NH4_INkg"," NH4_OUTkg"," NO2_INkg"," NO2_OUTkg"," MINP_INkg"," MINP_OUTkg"," CHLA_INkg"," CHLA_OUTkg"," CBOD_INkg"," CBOD_OUTkg"," DISOX_INkg"," DISOX_OUTkg"," SOLPST_INmg","SOLPST_OUTmg"," SORPST_I↩Nmg","SORPST_OUTmg"," REACTPSTmg"," VOLPSTmg"," SETTLPSTmg","RESUSP_PSTmg","DIFF↩USEPSTmg","REACBEDPSTmg"," BURYPSTmg"," BED_PSTmg"," BACTP_OUTct","BACTLP_OUTct"," CMETAL#1kg"," CMETAL#2kg"," CMETAL#3kg"," TOT Nkg"," TOT Pkg"," NO3ConcMg/l"," WTMPdegc"," "," "," "," "," "," "," "," "," "," "," "," "," "," "," "," "," "/)

  column headers for reach output file

- character(len=13), dimension(41), parameter parm::hedrsv = (/" VOLUMEm3"," FLOW_INcms"," FLOW_OUTcms"," PRECIPm3"," EVAPm3"," SEEPAGEm3"," SED_INtons"," SED_OUTtons"," SED_CONCppm"," ORGN_INkg"," ORGN_OUTkg"," RES_ORGNppm"," ORGP_INkg"," ORGP_OUTkg"," RES_ORGPppm"," NO3_INkg"," NO3_OUTkg"," RES_NO3ppm"," NO2_INkg"," NO2_OUTkg"," RES_NO2ppm"," NH3_INkg"," NH3_OUTkg"," RES_NH3ppm"," MINP_INkg"," MINP_OUTkg"," RES_MINPppm"," CHLA_INkg"," CHLA_OUTkg","SECCHIDEPTHm"," PEST_INmg"," REACTPSTmg"," VOLPSTmg"," SETTLPSTmg","RESUSP_PSTmg","DIFFUSEPSTmg","REACBEDPSTmg"," BURYPSTmg"," PEST_OUTmg","PSTCNCWmg/m3","PSTCNCBmg/m3"/)

  column headers for reservoir output file
- character(len=13), dimension(40), parameter parm::hedwtr = (/" PNDPCPmm"," PND_INmm","PSED_It/ha"," PNDEVPmm"," PNDSEPmm"," PND_OUTmm","PSED_Ot/ha"," PNDVOLm^3","PNDORGNppm"," PNDNO3ppm","PNDORGPppm","PNDMINPppm","PNDCHLAppm"," PNDSECIm"," WETPCPmm"," WET_INmm","WSED_It/ha"," WETEVPmm"," WETSEPmm"," WET_OUTmm","WSED_Ot/ha"," WETVOLm^3","WETORGNppm"," WETNO3ppm","WETORGPppm","WETMINPppm","WETCHLAppm"," WETSECIm"," POTPCPmm"," POT_INmm","OSED_It/ha"," POTEVPmm"," POTSEPmm"," POT_OUTmm","OSED_Ot/ha"," POTVOLm^3"," POT_SAha","HRU_SURQmm","PLANT_ETmm"," SOIL_ETmm"/)

  column headers for HRU impoundment output file
- integer, dimension(mhruo), parameter parm::icols = (/43,53,63,73,83,93,103,113,123,133,143,153,163,173,183,193,203,213,2

  space number for beginning of column in HRU output file (none)
- integer, dimension(msubo), parameter parm::icolb = (/35,45,55,65,75,85,95,105,115,125,135,145,155,165,175,185,195,205,21

  space number for beginning of column in subbasin output file (none)
- integer, dimension(mrcho), parameter parm::icolr = (/38,50,62,74,86,98,110,122,134,146,158,170,182,194,206,218,230,242,25

  space number for beginning of column in reach output file (none)
- integer, dimension(41), parameter parm::icolrsv = (/38,50,62,74,86,98,110,122,134,146,158,170,182,194,206,218,230,242,254

  space number for beginning of column in reservoir output file (none)
- real ∗8, parameter parm::ab = 0.02083

  lowest value al5 can have (mm H2O)
- integer, dimension(13), parameter **parm::ndays_leap** = (/0,31,60,91,121,152,182,213,244,274,305,335,366/)
- integer, dimension(13), parameter **parm::ndays_noleap** = (/0,31,59,90,120,151,181,212,243,273,304,334,365/)
- integer parm::icalen

  code for writing out calendar day or julian day to output.rch, .sub, .hru files;
  icalen = 0 (print julian day), 1 (print month/day/year);
  icalen MUST be == zero if IPRINT == 3 to print subdaily
- real ∗8 parm::prf_bsn

  Basinwide peak rate adjustment factor for sediment routing in the channel. Allows impact of peak flow rate on sediment routing and channel reshaping to be taken into account.
- real ∗8 **parm::co2_x2**
- real ∗8 **parm::co2_x**
- real ∗8, dimension(:), allocatable parm::cdn

  denitrification exponential rate coefficient
- real ∗8, dimension(:), allocatable parm::nperco

  nitrate percolation coefficient (0-1)
  0:concentration of nitrate in surface runoff is zero
  1:percolate has same concentration of nitrate as surface runoff
- real ∗8, dimension(:), allocatable parm::surlag

  Surface runoff lag time. This parameter is needed in subbasins where the time of concentration is greater than 1 day. SURLAG is used to create a "storage" for surface runoff to allow the runoff to take longer than 1 day to reach the subbasin outlet (days)
- real ∗8, dimension(:), allocatable parm::cmn

  rate factor for humus mineralization on active organic N
- real ∗8, dimension(:), allocatable parm::phoskd

  phosphorus soil partitioning coefficient. Ratio of soluble phosphorus in surface layer attached to sediment to phosphorus dissolved in soil water
- real ∗8, dimension(:), allocatable parm::psp

phosphorus availibility index. The fraction of fertilizer P remaining in labile pool after initial rapid phase of P sorption (none)

- real ∗8, dimension(:), allocatable parm::sdnco

  denitrification threshold: fraction of field capacity triggering denitrification
- real ∗8 parm::r2adj_bsn

  basinwide retention parameter adjustment factor (greater than 1)
- real ∗8 parm::pst_kg

  amount of pesticide applied to HRU (kg/ha)
- real ∗8 parm::yield

  yield (dry weight) (kg)
- real ∗8 parm::burn_frlb

  fraction of biomass and residue that burn(input in management file) range (0 - 1.0) (none)
- real ∗8 **parm::yieldgrn**
- real ∗8 **parm::yieldbms**
- real ∗8 **parm::yieldtbr**
- real ∗8 **parm::yieldn**
- real ∗8 **parm::yieldp**
- real ∗8 **parm::hi_bms**
- real ∗8 **parm::hi_rsd**
- real ∗8 **parm::yieldrsd**
- real ∗8, dimension(:,:), allocatable **parm::hru_rufr**
- real ∗8, dimension(:,:), allocatable **parm::daru_km**
- real ∗8, dimension(:,:), allocatable **parm::ru_k**
- real ∗8, dimension(:,:), allocatable **parm::ru_c**
- real ∗8, dimension(:,:), allocatable **parm::ru_eiq**
- real ∗8, dimension(:,:), allocatable **parm::ru_ovsl**
- real ∗8, dimension(:,:), allocatable **parm::ru_a**
- real ∗8, dimension(:,:), allocatable **parm::ru_ovs**
- real ∗8, dimension(:,:), allocatable **parm::ru_ktc**
- real ∗8, dimension(:), allocatable **parm::gwq_ru**
- real ∗8, dimension(:), allocatable **parm::qdayout**
- integer, dimension(:), allocatable **parm::ils2**
- integer, dimension(:), allocatable **parm::ils2flag**
- integer parm::ipest

  pesticide identification number from pest.dat (none)
- integer **parm::iru**
- integer **parm::mru**
- integer **parm::irch**
- integer **parm::isub**
- integer **parm::mhyd_bsn**
- integer **parm::ils_nofig**
- integer **parm::mhru1**
- real ∗8 **parm::wshd_sepno3**
- real ∗8 **parm::wshd_sepnh3**
- real ∗8 **parm::wshd_seporgn**
- real ∗8 **parm::wshd_sepfon**
- real ∗8 **parm::wshd_seporgp**
- real ∗8 **parm::wshd_sepfop**
- real ∗8 **parm::wshd_sepsolp**
- real ∗8 **parm::wshd_sepbod**
- real ∗8 **parm::wshd_sepmm**
- integer, dimension(:), allocatable **parm::isep_hru**
- real ∗8 parm::fixco

  nitrogen fixation coefficient

- real ∗8 parm::nfixmx

  maximum daily n-fixation (kg/ha)
- real ∗8 parm::res_stlr_co

  reservoir sediment settling coefficient
- real ∗8 parm::rsd_covco

  residue cover factor for computing fraction of cover
- real ∗8 parm::vcrit

  critical velocity
- real ∗8 parm::wshd_snob

  average amount of water stored in snow at the beginning of the simulation for the entire watershed (mm H20)
- real ∗8 parm::wshd_sw

  water in soil at beginning of simulation, or\ average amount of water stored in soil for the entire watershed, or\ difference between mass balance calculated from watershed averages and actual value for water in soil at end of simulation (goal is to have wshd_sw = 0.) (mm H2O)
- real ∗8 parm::wshd_pndfr

  fraction of watershed area which drains into ponds (none)
- real ∗8 parm::wshd_pndsed

  total amount of suspended sediment in ponds in the watershed (metric tons),
  or mass balance discrepancy for pond sediment expressed as loading per unit hectare of drainage area (metric tons/ha)
- real ∗8 parm::wshd_pndv

  total volume of water in ponds in the watershed (m^3), or mass balance discrepancy for pond water volume expressed as depth over drainage area (mm H2O)
- real ∗8 parm::percop

  pesticide percolation coefficient (0-1)
  0: concentration of pesticide in surface runoff is zero
  1: percolate has same concentration of pesticide as surface runoff
- real ∗8 parm::wshd_resfr

  fraction of watershed area that drains into reservoirs (none)
- real ∗8 parm::wshd_pndha

  watershed area in hectares which drains into ponds (ha)
- real ∗8 parm::wshd_resha

  watershed area in hectares which drains into reservoirs (ha)
- real ∗8 parm::wshd_fminp

  average annual amount of mineral P applied in watershed (kg P/ha)
- real ∗8 parm::wshd_fnh3

  average annual amount of NH3-N applied in watershed (kg N/ha)
- real ∗8 parm::wshd_fno3

  average annual amount of NO3-N applied in watershed (kg N/ha)
- real ∗8 parm::wshd_forgn

  average annual amount of organic N applied in watershed (kg N/ha)
- real ∗8 parm::wshd_ftotn

  average annual amount of N (mineral & organic) applied in watershed (kg N/ha)
- real ∗8 parm::wshd_forgp

  average annual amount of organic P applied in watershed (kg P/ha)
- real ∗8 parm::wshd_ftotp

  average annual amount of P (mineral & organic) applied in watershed (kg P/ha)
- real ∗8 parm::wshd_yldn

  amount of nitrogen removed from soil in watershed in the yield (kg N/ha)
- real ∗8 parm::wshd_yldp

  amount of phosphorus removed from soil in watershed in the yield (kg P/ha)
- real ∗8 parm::wshd_fixn

average annual amount of nitrogen added to plant biomass via fixation (kg N/ha)
- real ∗8 parm::wshd_pup

  average annual amount of plant uptake of phosphorus (kg P/ha)
- real ∗8 parm::wshd_nstrs

  average annual number of nitrogen stress units in watershed (stress units)
- real ∗8 parm::wshd_pstrs

  average annual number of phosphorus stress units in watershed (stress units)
- real ∗8 parm::wshd_tstrs

  average annual number of temperature stress units in watershed (stress units)
- real ∗8 parm::wshd_wstrs

  average annual number of water stress units in watershed (stress units)
- real ∗8 **parm::wshd_astrs**
- real ∗8 parm::ffcb

  initial soil water content expressed as a fraction of field capacity
- real ∗8 parm::wshd_dnit

  average annual amount of nitrogen lost from nitrate pool due to denitrification in watershed (kg N/ha)
- real ∗8 parm::wshd_hmn

  average annual amount of nitrogen moving from active organic to nitrate pool in watershed (kg N/ha)
- real ∗8 parm::wshd_hmp

  average annual amount of phosphorus moving from organic to labile pool in watershed (kg P/ha)
- real ∗8 parm::wshd_rmn

  average annual amount of nitrogen moving from fresh organic (residue) to nitrate and active organic pools in watershed (kg N/ha)
- real ∗8 parm::wshd_rwn

  average annual amount of nitrogen moving from active organic to stable organic pool in watershed (kg N/ha)
- real ∗8 parm::wdpq

  die-off factor for persistent bacteria in soil solution (1/day)
- real ∗8 parm::wshd_rmp

  average annual amount of phosphorus moving from fresh organic (residue) to labile and organic pools in watershed (kg P/ha)
- real ∗8 parm::wshd_nitn

  average annual amount of nitrogen moving from the NH3 to the NO3 pool by nitrification in the watershe (kg N/ha)d
- real ∗8 parm::wshd_voln

  average annual amount if nitrogen lost by ammonia volatilization in watershed (kg N/ha)
- real ∗8 parm::wshd_pal

  average annual amount of phosphorus moving from labile mineral to active mineral pool in watershed (kg P/ha)
- real ∗8 parm::wshd_pas

  average annual amount of phosphorus moving from active mineral to stable mineral pool in watershed (kg P/ha)
- real ∗8 parm::wof_p

  fraction of persistent bacteria on foliage that is washed off by a rainfall event (none)
- real ∗8 parm::wshd_raino3

  average annual amount of NO3 added to soil by rainfall in watershed (kg N/ha)
- real ∗8 parm::wshd_plch

  average annual amount of phosphorus leached into second soil layer (kg P/ha)
- real ∗8 **parm::ressedc**
- real ∗8 **parm::basno3f**
- real ∗8 **parm::basorgnf**
- real ∗8 **parm::wshd_pinlet**
- real ∗8 **parm::wshd_ptile**
- real ∗8 parm::sftmp

  Snowfall temperature (deg C)
- real ∗8 parm::smfmn

Minimum melt rate for snow during year (Dec. 21) where deg C refers to the air temperature. (mm/deg C/day)

- real ∗8 parm::smfmx

  Maximum melt rate for snow during year (June 21) where deg C refers to the air temperature. SMFMX and SMFMN allow the rate of snow melt to vary through the year. These parameters are accounting for the impact of soil temperature on snow melt. (mm/deg C/day)

- real ∗8 parm::smtmp

  Snow melt base temperature. Mean air temperature at which snow melt will occur. (deg C)

- real ∗8 **parm::basminpf**
- real ∗8 **parm::basorgpf**
- real ∗8 parm::wshd_ressed

  total amount of suspended sediment in reservoirs in the watershed (metric tons),
  or mass balance discrepancy for reservoir sediment expressed as loading per unit hectare of drainage area (metric tons/ha)

- real ∗8 parm::wshd_resv

  total volume of water in all reservoirs in the watershed (m^3),
  or mass balance discrepancy for reservoir water volume expressed as depth over drainage area (mm H2O)

- real ∗8 parm::basminpi

  average amount of phosphorus initially in the mineral P pool in watershed soil (kg P/ha)

- real ∗8 parm::basno3i

  average amount of nitrogen initially in the nitrate pool in watershed soil (kg N/ha)

- real ∗8 parm::basorgni

  average amount of nitrogen initially in the organic N pool in watershed soil (kg N/ha)

- real ∗8 parm::basorgpi

  average amount of phosphorus initially in the organic P pool in watershed soil (kg P/ha)

- real ∗8 parm::peakr

  peak runoff rate for the day in HRU or channel (m^3/s)

- real ∗8 parm::albday

  albedo of ground for the day in HRU, the fraction of the solar radiation reflected at the soil surface back into space (none)

- real ∗8 parm::pndsedin

  sediment inflow to the pond from HRU during day (metric tons)

- real ∗8 parm::sw_excess

  amount of water stored in soil layer on the current day that exceeds field capacity (gravity drained water) (mm H2O)

- real ∗8 parm::timp

  Snow pack temperature lag factor (0-1)
  1 = no lag (snow pack temp=current day air temp) as the lag factor goes to zero, the snow pack's temperature will be less influenced by the current day's air temperature.

- real ∗8 parm::wt_shall

  shallow water table depth above the impervious layer (mm H2O)

- real ∗8 **parm::sq_rto**
- real ∗8 parm::qtile

  amount of water in drainage tile flow in HRU soil layer for the day (mm H2O)

- real ∗8 parm::inflpcp

  amount of precipitation that infiltrates into soil (enters soil) (mm H2O)

- real ∗8 parm::fixn

  amount of nitrogen added to the plant biomass via fixation on the day in HRU (kg N/ha)

- real ∗8 parm::latlyr

  amount of water in lateral flow in layer in HRU for the day (mm H2O)

- real ∗8 parm::snofall

  amount of precipitation falling as freezing rain/snow on day in HRU (mm H2O)

- real ∗8 parm::snomlt

  amount of water in snow melt for the day in HRU (mm H2O)

- real ∗8 parm::tloss

amount of water removed from surface runoff via transmission losses on day in HRU (mm H2O)

- real ∗8 **parm::lpndloss**
- real ∗8 **parm::lwetloss**
- real ∗8 parm::bioday

  biomass generated on current day in HRU (kg)
- real ∗8 parm::cfertn

  total amount of nitrogen applied to soil during continuous fertilizer operation in HRU on day (kg N/ha)
- real ∗8 parm::cfertp

  amount of phosphorus applied to soil during continuous fertilizer operation in HRU on day (kg P/ha)
- real ∗8 parm::fertn

  total amount of nitrogen applied to soil in HRU on day in fertilizer application (kg N/ha)
- real ∗8 parm::sepday

  micropore percolation from bottom of the soil layer on day in HRU (mm H2O)
- real ∗8 parm::sol_rd

  current rooting depth (mm)
- real ∗8 parm::sedrch

  sediment transported out of channel or reach during time step (metric tons)
- real ∗8 **parm::sepcrktot**
- real ∗8 **parm::fertno3**
- real ∗8 **parm::fertnh3**
- real ∗8 **parm::fertorgn**
- real ∗8 **parm::fertsolp**
- real ∗8 **parm::fertorgp**
- real ∗8 parm::qdfr

  fraction of water yield that is surface runoff (none)
- real ∗8 parm::fertp

  total amount of phosphorus applied to soil in HRU on day in fertilizer application (kg P/ha)
- real ∗8 parm::grazn

  amount of nitrogen added to soil in grazing on the day in HRU (kg N/ha)
- real ∗8 parm::grazp

  amount of phosphorus added to soil in grazing on the day in HRU (kg P/ha)
- real ∗8 parm::soxy

  saturation dissolved oxygen concentration (mg/L)
- real ∗8 parm::rtwtr

  water leaving reach on day (m^3 H2O)
- real ∗8 parm::sdti

  average flow rate in reach for day (m^3/s)
- real ∗8 **parm::ressa**
- real ∗8 parm::da_km

  area of the watershed in square kilometers (km^2)
- real ∗8 parm::rchdep

  depth of flow on day (m)
- real ∗8 parm::rtevp

  evaporation from reach on day (m^3 H2O)
- real ∗8 parm::rttime

  reach travel time (hour)
- real ∗8 parm::rttlc

  transmission losses from reach on day (m^3 H2O)
- real ∗8 **parm::resflwi**
- real ∗8 parm::wdprch

  die-off factor for persistent bacteria in streams (1/day)

- real ∗8 **parm::resflwo**
- real ∗8 **parm::respcp**
- real ∗8 **parm::resev**
- real ∗8 **parm::ressep**
- real ∗8 **parm::ressedi**
- real ∗8 **parm::ressedo**
- real ∗8 parm::pperco_bsn

  phosphorus percolation coefficient. Ratio of soluble phosphorus in surface to soluble phosphorus in percolate
- real ∗8 parm::nperco_bsn

  basin nitrate percolation coefficient (0-1)
  0:concentration of nitrate in surface runoff is zero
  1:percolate has same concentration of nitrate as surface runoff
- real ∗8 parm::rsdco

  residue decomposition coefficient. The fraction of residue which will decompose in a day assuming optimal moisture, temperature, C:N ratio, and C:P ratio
- real ∗8 parm::voltot

  total volume of cracks expressed as depth per unit area (mm)
- real ∗8 **parm::phoskd_bsn**
- real ∗8 parm::msk_x

  weighting factor controling relative importance of inflow rate and outflow rate in determining storage on reach
- real ∗8 parm::volcrmin

  minimum crack volume allowed in any soil layer (mm), or
  minimum soil volume in profile (mm)
- real ∗8 parm::bactkdq

  bacteria soil partitioning coefficient. Ratio of solution bacteria in surface layer to solution bacteria in runoff soluble and sorbed phase in surface runoff.
- real ∗8 parm::canev

  amount of water evaporated from canopy storage (mm H2O)
- real ∗8 parm::precipday

  precipitation, or effective precipitation reaching soil surface, for the current day in HRU (mm H2O)
- real ∗8 parm::uno3d

  plant nitrogen deficiency for day in HRU (kg N/ha)
- real ∗8 parm::usle

  daily soil loss predicted with USLE equation (metric tons/ha)
- real ∗8 parm::rcn

  concentration of nitrogen in the rainfall (mg/L)
- real ∗8 **parm::surlag_bsn**
- real ∗8 parm::thbact

  temperature adjustment factor for bacteria die-off/growth
- real ∗8 parm::wlpq20

  overall rate change for less persistent bacteria in soil solution (1/day)
- real ∗8 parm::wlps20

  overall rate change for less persistent bacteria adsorbed to soil particles (1/day)
- real ∗8 parm::wpq20

  overall rate change for persistent bacteria in soil solution (1/day)
- real ∗8 parm::wps20

  overall rate change for persistent bacteria adsorbed to soil particles (1/day)
- real ∗8 parm::bactrop

  persistent bacteria transported to main channel with surface runoff (# colonies/ha)
- real ∗8 parm::bactsedp

  persistent bacteria transported with sediment in surface runoff (# colonies/ha)
- real ∗8 parm::enratio

enrichment ratio calculated for current day in HRU (none)

- real ∗8 parm::pndpcp

    precipitation on pond during day (m^3 H2O)
- real ∗8 parm::wetpcp

    precipitation on wetland for day (m^3 H2O)
- real ∗8 parm::wetsep

    seepage from wetland bottom for day (m^3 H2O)
- real ∗8 parm::pndev

    evaporation from pond on day (m^3 H2O)
- real ∗8 parm::pndflwi

    volume of water flowing into pond on day (m^3 H2O)
- real ∗8 parm::pndsedo

    sediment leaving pond during day (metric tons)
- real ∗8 parm::pndsep

    seepage from pond on day (m^3 H2O)
- real ∗8 parm::wetev

    evaporation from wetland for day (m^3 H2O)
- real ∗8 parm::wetflwi

    volume of water flowing in wetland on day (m^3 H2O)
- real ∗8 parm::wetsedo

    sediment loading from wetland for day (metric tons)
- real ∗8 parm::da_ha

    drainage area of watershed in hectares (ha)
- real ∗8 parm::pndflwo

    volume of water flowing out of pond on day (m^3 H2O)
- real ∗8 parm::vpd

    vapor pressure deficit (kPa)
- real ∗8 parm::wetflwo

    volume of water flowing out wetland on day (m^3 H2O)
- real ∗8 parm::wetsedi

    sediment loading to wetland for day (metric tons)
- real ∗8 parm::evlai

    leaf area index at which no evaporation occurs. This variable is used in ponded HRUs (eg rice) where evaporation from the water surface is restricted by the plant canopy cover. Evaporation from the water surface equals potential ET when LAI = 0 and decreased linearly to O when LAI = EVLAI
- real ∗8 parm::evrch

    Reach evaporation adjustment factor. Evaporation from the reach is multiplied by EVRCH. This variable was created to limit the evaporation predicted in arid regions.
- real ∗8 parm::wdlpf

    die-off factor for less persistent bacteria on foliage (1/day)
- real ∗8 parm::ep_day

    actual amount of transpiration that occurs on day in HRU (mm H2O)
- real ∗8 parm::pet_day

    potential evapotranspiration on current day in HRU (mm H2O)
- real ∗8 parm::bactrolp

    less persistent bacteria transported to main channel with surface runoff (# colonies/ha)
- real ∗8 parm::bactsedlp

    less persistent bacteria transported with sediment in surface runoff (# colonies/ha)
- real ∗8 parm::adj_pkr

    peak rate adjustment factor in the subbasin. Used in the MUSLE equation to account for impact of peak flow on erosion (none)

- real ∗8 parm::n_updis

  nitrogen uptake distribution parameter. This parameter controls the amount of nitrogen removed from the different soil layer layers by the plant. In particular, this parameter allows the amount of nitrogen removed from the surface layer via plant uptake to be controlled. While the relationship between UBN and N removed from the surface layer is affected by the depth of the soil profile, in general, as UBN increases the amount of N removed from the surface layer relative to the amount removed from the entire profile increases
- real ∗8 parm::nactfr

  nitrogen active pool fraction. The fraction of organic nitrogen in the active pool (none)
- real ∗8 parm::p_updis

  phosphorus uptake distribution parameter This parameter controls the amount of phosphorus removed from the different soil layers by the plant. In particular, this parameter allows the amount of phosphorus removed from the surface layer via plant uptake to be controlled. While the relationship between UBP and P uptake from the surface layer is affected by the depth of the soil profile, in general, as UBP increases the amount of P removed from the surface layer relative to the amount removed from the entire profile increases
- real ∗8 parm::snoev

  amount of water in snow lost through sublimation on current day in HRU (mm H2O)
- real ∗8 parm::sno3up

  amount of nitrate moving upward in the soil profile in watershed (kg N/ha)
- real ∗8 parm::reactw

  amount of pesticide in reach that is lost through reactions (mg pst)
- real ∗8 parm::es_day

  actual amount of evaporation (soil et) that occurs on day in HRU (mm H2O)
- real ∗8 parm::sdiegrolpq

  average annual change in the number of less persistent bacteria colonies in soil solution in watershed (# cfu/m^2)
- real ∗8 parm::sdiegrolps

  average annual change in the number of less persistent bacteria colonies on soil particles in watershed (# cfu/m^2)
- real ∗8 parm::sdiegropq

  average annual change in the number of persistent bacteria colonies in soil solution in watershed (# cfu/m^2)
- real ∗8 parm::sdiegrops

  average annual change in the number of persistent bacteria colonies on soil particles in watershed (# cfu/m^2)
- real ∗8 parm::wof_lp

  fraction for less persistent bacteria on foliage that is washed off by a rainfall event (none)
- real ∗8 parm::ep_max

  maximum amount of transpiration (plant et) that can occur on day in HRU (mm H2O)
- real ∗8 parm::sbactrolp

  average annual number of less persistent bacteria transported to main channel with surface runoff in solution (# colonies/ha)
- real ∗8 parm::sbactrop

  average annual number of persistent bacteria transported to main channel with surface runoff in solution (# colonies/ha)
- real ∗8 parm::sbactsedlp

  average annual number of less persistent bacteria transported with sediment in surface runoff (# colonies/ha)
- real ∗8 parm::sbactsedp

  average annual number of persistent bacteria transported with sediment in surface runoff (# colonies/ha)
- real ∗8 parm::sbactlchlp

  average annual number of less persistent bacteria lost from soil surface layer by percolation (# cfu/m^2)
- real ∗8 parm::sbactlchp

  average annual number of persistent bacteria lost from soil surface layer by percolation (# cfu/m^2)
- real ∗8 parm::rchwtr

  water stored in reach at beginning of day (m^3 H2O)
- real ∗8 parm::resuspst

  amount of pesticide moving from sediment to reach due to resuspension (mg pst)
- real ∗8 parm::setlpst

amount of pesticide moving from water to sediment due to settling (mg pst)

- real ∗8 **parm::psp_bsn**
- real ∗8 parm::bsprev

  surface runoff lagged from prior day of simulation (mm H2O)
- real ∗8 parm::bssprev

  lateral flow lagged from prior day of simulation (mm H2O)
- real ∗8 parm::spadyev

  average annual amount of water removed from potholes by evaporation in watershed (mm H2O)
- real ∗8 parm::spadyo

  average annual amount of water released to main channel from potholes in watershed (mm H2O)
- real ∗8 parm::spadyrfv

  average annual amount of precipitation on potholes in watershed (mm H2O)
- real ∗8 parm::spadysp

  average annual amount of water removed from potholes by seepage in watershed (mm H2O)
- real ∗8 **parm::spadyosp**
- real ∗8 parm::qday

  amount of surface runoff loading to main channel from HRU on current day (includes effects of transmission losses) (mm H2O)
- real ∗8 parm::al5

  fraction of total rainfall that occurs during 0.5h of highest intensity rain (none)
- real ∗8 parm::no3pcp

  nitrate added to the soil in rainfall (kg N/ha)
- real ∗8 parm::pndsedc

  net change in sediment in pond during day (metric tons)
- real ∗8 parm::usle_ei

  USLE rainfall erosion index on day for HRU (100(ft-tn in)/(acre-hr))
- real ∗8 parm::rcharea

  cross-sectional area of flow (m^2)
- real ∗8 parm::volatpst

  amount of pesticide lost from reach by volatilization (mg pst)
- real ∗8 parm::ubw

  water uptake distribution parameter. This parameter controls the amount of water removed from the different soil layers by the plant. In particular, this parameter allows the amount of water removed from the surface layer via plant uptake to be controlled. While the relationship between UBW and H2O removed from the surface layer is affected by the depth of the soil profile, in general, as UBW increases the amount of water removed from the surface layer relative to the amount removed from the entire profile increases
- real ∗8 parm::uobn

  nitrogen uptake normalization parameter. This variable normalizes the nitrogen uptake so that the model can easily verify that upake from the different soil layers sums to 1.0
- real ∗8 parm::uobp

  phosphorus uptake normalization parameter. This variable normalizes the phosphorus uptake so that the model can easily verify that uptake from the different soil layers sums to 1.0
- real ∗8 parm::uobw

  water uptake normalization parameter. This variable normalizes the water uptake so that the model can easily verify that uptake from the different soil layers sums to 1.0
- real ∗8 parm::wglpf

  growth factor for less persistent bacteria on foliage (1/day)
- real ∗8 parm::wetsedc

  net change in sediment in wetland during day (metric tons)
- real ∗8 **parm::respesti**
- real ∗8 parm::rcor

  correction coefficient for generated rainfall to ensure that the annual means for generated and observed values are comparable (needed only if IDIST=1)

- real ∗8 parm::rexp

  value of exponent for mixed exponential rainfall distribution (needed only if IDIST=1)
- real ∗8 parm::snocov1

  1st shape parameter for snow cover equation. This parameter is determined by solving the equation for 50% snow cover
- real ∗8 parm::snocov2

  2nd shape parameter for snow cover equation. This parameter is determined by solving the equation for 95% snow cover
- real ∗8 parm::snocovmx

  Minimum snow water content that corresponds to 100% snow cover. If the snow water content is less than SNOC←OVMX, then a certain percentage of the ground will be bare (mm H2O)
- real ∗8 parm::lyrtile

  drainage tile flow in soil layer for day in HRU (mm H2O)
- real ∗8 **parm::lyrtilex**
- real ∗8 parm::sno50cov

  Fraction of SNOCOVMX that corresponds to 50% snow cover. SWAT assumes a nonlinear relationship between snow water and snow cover.
- real ∗8 parm::ai0

  ratio of chlorophyll-a to algal biomass (ug chla/mg alg)
- real ∗8 parm::ai1

  fraction of algal biomass that is nitrogen (mg N/mg alg)
- real ∗8 parm::ai2

  fraction of algal biomass that is phosphorus (mg P/mg alg)
- real ∗8 parm::ai3

  the rate of oxygen production per unit of algal photosynthesis (mg O2/mg alg)
- real ∗8 parm::ai4

  the rate of oxygen uptake per unit of algae respiration (mg O2/mg alg)
- real ∗8 parm::ai5

  the rate of oxygen uptake per unit of NH3 nitrogen oxidation (mg O2/mg N)
- real ∗8 parm::ai6

  the rate of oxygen uptake per unit of NO2 nitrogen oxidation (mg O2/mg N)
- real ∗8 parm::rhoq

  algal respiration rate at 20 deg C (1/day or 1/hr)
- real ∗8 parm::tfact

  fraction of solar radiation computed in the temperature heat balance that is photosynthetically active
- real ∗8 parm::k_l

  half-saturation coefficient for light (MJ/(m2∗hr))
- real ∗8 parm::k_n

  michaelis-menton half-saturation constant for nitrogen (mg N/L)
- real ∗8 parm::k_p

  michaelis-menton half saturation constant for phosphorus (mg P/L)
- real ∗8 parm::lambda0

  non-algal portion of the light extinction coefficient (1/m)
- real ∗8 parm::lambda1

  linear algal self-shading coefficient (1/(m∗ug chla/L))
- real ∗8 parm::lambda2

  nonlinear algal self-shading coefficient ((1/m)(ug chla/L)∗∗(-2/3))
- real ∗8 parm::mumax

  maximum specific algal growth rate at 20 deg C(1/day or 1/hr)
- real ∗8 parm::p_n

  algal preference factor for ammonia

- real ∗8 parm::rnum1

  variable to hold value for rnum1s(:) (none)
- real ∗8 parm::etday

  actual evapotranspiration occuring on day in HRU (mm H2O)
- real ∗8 parm::auton

  amount of nitrogen applied in auto-fert application (kg N/ha)
- real ∗8 parm::autop

  amount of phosphorus applied in auto-fert application (kg P/ha)
- real ∗8 parm::hmntl

  amount of nitrogen moving from active organic to nitrate pool in soil profile on current day in HRU (kg N/ha)
- real ∗8 parm::hmptl

  amount of phosphorus moving from active organic to nitrate pool in soil profile on current day in HRU (kg P/ha)
- real ∗8 parm::rmn2tl

  amount of nitrogen moving from the fresh organic (residue) to the nitrate(80%) and active organic(20%) pools in soil profile on current day in HRU (kg N/ha)
- real ∗8 parm::rwntl

  amount of nitrogen moving from active organic to stable organic pool in soil profile on current day in HRU (kg N/ha)
- real ∗8 parm::gwseep

  amount of water recharging deep aquifer on current day in HRU (mm H2O)
- real ∗8 parm::revapday

  amount of water moving from the shallow aquifer into the soil profile or being taken up by plant roots in the shallow aquifer or in the bank storage zone (mm H2O)
- real ∗8 parm::rmp1tl

  amount of phosphorus moving from the labile mineral pool to the active mineral pool in the soil profile on the current day in the HRU (kg P/ha)
- real ∗8 parm::rmptl

  amount of phosphorus moving from the fresh organic (residue) to the labile(80%) and organic(20%) pools in soil profile on current day in HRU (kg P/ha)
- real ∗8 parm::roctl

  amount of phosphorus moving from the active mineral pool to the stable mineral pool in the soil profile on the current day in the HRU (kg P/ha)
- real ∗8 parm::wdntl

  amount of nitrogen lost from nitrate pool by denitrification in soil profile on current day in HRU (kg N/ha)
- real ∗8 **parm::cmn_bsn**
- real ∗8 **parm::reswtr**
- real ∗8 parm::wdlprch

  die-off factor for less persistent bacteria in streams (1/day)
- real ∗8 parm::wdpres

  die-off factor for persistent bacteria in reservoirs (1/day)
- real ∗8 parm::petmeas

  potential ET value read in for day (mm H2O)
- real ∗8 parm::bury

  loss of pesticide from active sediment layer by burial (mg pst)
- real ∗8 parm::difus

  diffusion of pesticide from sediment to reach (mg pst)
- real ∗8 parm::reactb

  amount of pesticide in sediment that is lost through reactions (mg pst)
- real ∗8 parm::solpesto

  soluble pesticide concentration in outflow on day (mg pst/m^3)
- real ∗8 parm::wdlpres

  die-off factor for less persistent bacteria in reservoirs (1/day)
- real ∗8 parm::sorpesto

sorbed pesticide concentration in outflow on day (mg pst/m^3)

- real ∗8 **parm::spcon_bsn**
- real ∗8 **parm::spexp_bsn**
- real ∗8 **parm::solpesti**
- real ∗8 **parm::sorpesti**
- real ∗8 parm::msk_co1

  calibration coefficient to control impact of the storage time constant for the reach at bankfull depth (phi(10,:) upon the storage time constant for the reach used in the Muskingum flow method
- real ∗8 parm::msk_co2

  calibration coefficient to control impact of the storage time constant for the reach at 0.1 bankfull depth (phi(13,:) upon the storage time constant for the reach used in the Muskingum flow method
- real ∗8 parm::deepstp

  depth of water in deep aquifer in HRU (mm H2O)
- real ∗8 parm::shallstp

  depth of water in shallow aquifer in HRU on previous day (mm H2O)
- real ∗8 parm::snoprev

  amount of water stored as snow on previous day (mm H2O)
- real ∗8 parm::swprev

  amount of water stored in soil profile in the HRU on the previous day (mm H2O)
- real ∗8 **parm::ressolpo**
- real ∗8 **parm::resorgno**
- real ∗8 **parm::resorgpo**
- real ∗8 **parm::resno3o**
- real ∗8 **parm::reschlao**
- real ∗8 **parm::resno2o**
- real ∗8 parm::potevmm

  volume of water evaporated from pothole expressed as depth over HRU (mm H2O)
- real ∗8 parm::potflwo

  volume of water released to main channel from pothole expressed as depth over HRU (mm H2O)
- real ∗8 parm::potpcpmm

  precipitation falling on pothole water body expressed as depth over HRU (mm H2O)
- real ∗8 parm::potsepmm

  seepage from pothole expressed as depth over HRU (mm H2O)
- real ∗8 parm::qdbank

  streamflow contribution from bank storage (m^3 H2O)
- real ∗8 **parm::resnh3o**
- real ∗8 parm::bactminlp

  Threshold detection level for less persistent bacteria. When bacteria levels drop to this amount the model considers bacteria in the soil to be insignificant and sets the levels to zero (cfu/m^2)
- real ∗8 parm::bactminp

  Threshold detection level for persistent bacteria. When bacteria levels drop to this amount the model considers bacteria in the soil to be insignificant and sets the levels to zero (cfu/m^2)
- real ∗8 parm::trnsrch

  fraction of transmission losses from main channel that enter deep aquifer
- real ∗8 parm::wp20p_plt

  overall rate change for persistent bacteria on foliage (1/day)
- real ∗8 parm::potsedo

  sediment leaving pothole to main channel from HRU on day (metric tons/ha)
- real ∗8 **parm::pest_sol**
- real ∗8 parm::bact_swf

  fraction of manure containing active colony forming units (cfu)
- real ∗8 parm::bactmx

bacteria percolation coefficient. Ratio of solution bacteria in surface layer to solution bacteria in percolate

- real ∗8 parm::cncoef

  plant ET curve number coefficient
- real ∗8 parm::wp20lp_plt

  overall rate change for less persistent bacteria on foliage (1/day)
- real ∗8 **parm::cdn_bsn**
- real ∗8 **parm::sdnco_bsn**
- real ∗8 **parm::bactmin**
- real ∗8 parm::cn_froz

  drainge coefficient (mm day -1)
- real ∗8 parm::dorm_hr

  time threshold used to define dormant (hours)
- real ∗8 parm::smxco

  adjustment factor for max curve number s factor (0-1)
- real ∗8 parm::tb_adj

  adjustment factor for subdaily unit hydrograph basetime
- real ∗8 parm::chla_subco

  regional adjustment on sub chla_a loading (fraction)
- real ∗8 parm::depimp_bsn

  depth to impervious layer. Used to model perched water tables in all HRUs in watershed (mm)
- real ∗8 parm::ddrain_bsn

  depth to the sub-surface drain (mm)
- real ∗8 parm::tdrain_bsn

  time to drain soil to field capacity (hours)
- real ∗8 **parm::gdrain_bsn**
- real ∗8 **parm::rch_san**
- real ∗8 **parm::rch_sil**
- real ∗8 **parm::rch_cla**
- real ∗8 **parm::rch_sag**
- real ∗8 **parm::rch_lag**
- real ∗8 **parm::rch_gra**
- real ∗8 parm::hlife_ngw_bsn

  Half-life of nitrogen in groundwater? (days)
- real ∗8 **parm::ch_opco_bsn**
- real ∗8 **parm::ch_onco_bsn**
- real ∗8 parm::decr_min

  Minimum daily residue decay.
- real ∗8 parm::rcn_sub_bsn

  Concentration of nitrogen in the rainfall (mg/kg)
- real ∗8 **parm::bc1_bsn**
- real ∗8 **parm::bc2_bsn**
- real ∗8 **parm::bc3_bsn**
- real ∗8 **parm::bc4_bsn**
- real ∗8 **parm::anion_excl_bsn**
- real ∗8, dimension(:), allocatable parm::wat_tbl

  water table based on depth from soil surface (mm)
- real ∗8, dimension(:), allocatable **parm::sol_swpwt**
- real ∗8, dimension(:,:), allocatable **parm::vwt**
- real ∗8 parm::re_bsn

  Effective radius of drains (range 3.0 - 40.0) (mm)
- real ∗8 parm::sdrain_bsn

  Distance bewtween two drain or tile tubes (range 7600.0 - 30000.0) (mm)

- real ∗8 **parm::sstmaxd_bsn**
- real ∗8 parm::drain_co_bsn

  Drainage coeffcient (range 10.0 - 51.0) (mm-day-1)
- real ∗8 parm::latksatf_bsn

  Multiplication factor to determine lateral ksat from SWAT ksat input value for HRU (range 0.01 - 4.0)
- real ∗8 parm::pc_bsn

  Pump capacity (def val = 1.042 mm h-1 or 25 mm day-1) (mm h-1)
- integer parm::idlast

  number of days simulated in month (none)
- integer **parm::i_subhw**
- integer **parm::imgt**
- integer **parm::iwtr**
- integer **parm::ifrttyp**
- integer **parm::mo_atmo**
- integer **parm::mo_atmo1**
- integer **parm::ifirstatmo**
- integer **parm::iyr_atmo**
- integer **parm::iyr_atmo1**
- integer **parm::matmo**
- integer parm::mch

  maximum number of channels
- integer parm::mcr

  maximum number of crops grown per year
- integer parm::mcrdb

  maximum number of crops/landcover in database file (crop.dat)
- integer parm::mfcst

  maximum number of forecast stations
- integer parm::mfdb

  maximum number of fertilizers in fert.dat
- integer parm::mhru

  maximum number of HRUs in watershed
- integer parm::mhyd

  maximum number of hydrograph nodes
- integer parm::mpdb

  maximum number of pesticides in pest.dat
- integer parm::mrg

  maximum number of rainfall/temp gages (none)
- integer parm::mcut

  maximum number of cuttings per year
- integer parm::mgr

  maximum number of grazings per year
- integer parm::mnr

  maximum number of years of rotation
- integer parm::myr

  maximum number of years of simulation
- integer parm::isubwq

  subbasin water quality code
  0 do not calculate algae/CBOD 1 calculate algae/CBOD drainmod tile equations
- integer **parm::ffcst**
- integer parm::isproj

  special project code (none):
  1 test rewind (run simulation twice)

- integer parm::nbyr

  number of calendar years simulated (none)
- integer parm::irte

  water routing method (none):
  0 variable storage method
  1 Muskingum method

- integer parm::nrch

  number of reaches in watershed (none)
- integer parm::nres

  total number of reservoirs in watershed (none)
- integer parm::nhru

  number of last HRU in previous subbasin or
  number of HRUs in watershed (none)
- integer parm::i_mo

  current month being simulated or month of next day of simulation (none)
- integer parm::immo

  current cumulative month of simulation (none)
- integer **parm::mo**
- integer parm::wndsim

  wind speed input code (noen)
  1 measured data read for each subbasin
  2 data simulated for each subbasin
- integer parm::icode

  variable to hold value for icodes(:) (none)
- integer parm::ihout

  variable to hold value for ihouts(:) (none)
- integer parm::inum1

  variable to hold value for inum1s(:) (subbasin number) (none)
- integer parm::inum2

  variable to hold value for inum2s(:) (none)
- integer parm::inum3

  variable to hold value for inum3s(:) (none)
- integer parm::inum4

  variable to hold value for inum4s(:) (none)
- integer parm::icfac

  icfac = 0 for C-factor calculation using Cmin (as described in manual)
  = 1 for new C-factor calculation from RUSLE (no minimum needed)
- integer **parm::inum5**
- integer **parm::inum6**
- integer **parm::inum7**
- integer **parm::inum8**
- integer parm::mrech

  maximum number of rechour files
- integer parm::nrgage

  number of raingage files (none)
- integer parm::nrgfil

  number of rain gages per file (none)
- integer parm::nrtot

  total number of rain gages (none)
- integer parm::ntgage

  number of temperature gage files (none)

- integer parm::ntgfil

  number of temperature gages per file (none)

- integer parm::nttot

  total number of temperature gages (none)

- integer parm::tmpsim

  temperature input code (none)
  1 measured data read for each subbasin
  2 data simulated for each subbasin

- integer parm::icrk

  crack flow code
  1: simulate crack flow in watershed

- integer parm::irtpest

  number of pesticide to be routed through the watershed. Redefined to the sequence number of pestcide in NPNO(:) which is to be routed through the watershed (none)

- integer parm::igropt

  Qual2E option for calculating the local specific growth rate of algae
  1: multiplicative.

- integer parm::lao

  Qual2E light averaging option. Qual2E defines four light averaging options. The only option currently available in SWAT is #2.

- integer parm::npmx

  number of different pesticides used in the simulation (none)

- integer parm::curyr

  current year in simulation (sequence) (none)

- integer parm::itdrn

  tile drainage equations flag/code
  1 simulate tile flow using subroutine drains(wt_shall)
  0 simulate tile flow using subroutine origtile(wt_shall,d)

- integer parm::iwtdn

  water table depth algorithms flag/code
  1 simulate wt_shall using subroutine new water table depth routine
  0 simulate wt_shall using subroutine original water table depth routine

- integer parm::ismax

  maximum depressional storage selection flag/code (none)
  0 = static depressional storage (stmaxd) read from .bsn for the global value or .sdr for specific HRUs
  1 = dynamic storage (stmaxd) based on random roughness, tillage and cumulative rainfall intensity by depstor.f90

- integer parm::iroutunit

  not being implemented in this version drainmod tile equations

- integer **parm::ires_nut**
- integer parm::iclb

  auto-calibration flag

- integer parm::mrecc

  maximum number of reccnst files

- integer parm::mrecd

  maximum number of recday files

- integer parm::mrecm

  maximum number of recmon files

- integer parm::mtil

  max number of tillage types in till.dat

- integer parm::mudb

  maximum number of urban land types in urban.dat

- integer parm::idist

rainfall distribution code
0 for skewed normal dist
1 for mixed exponential distribution

- integer parm::mrecy

    maximum number of recyear files

- integer parm::nyskip

    number of years to skip output summarization and printing (none)

- integer parm::slrsim

    solar radiation input code (none)
    1 measured data read for each subbasin
    2 data simulated for each subbasin

- integer parm::ideg

    channel degredation code
    0: do not compute channel degradation
    1: compute channel degredation (downcutting and widening)

- integer parm::ievent

    rainfall/runoff code (none)
    0 daily rainfall/curve number technique 1 sub-daily rainfall/Green&Ampt/hourly routing 3 sub-daily rainfall/↩ Green&Ampt/hourly routing

- integer parm::ipet

    code for potential ET method (none)
    0 Priestley-Taylor method
    1 Penman/Monteith method
    2 Hargreaves method
    3 read in daily potential ET data

- integer **parm::iopera**
- integer parm::idaf

    beginning day of simulation (julian date)

- integer parm::idal

    ending day of simulation (julian date)

- integer parm::rhsim

    relative humidity input code (none)
    1 measured data read for each subbasin
    2 data simulated for each subbasin

- integer parm::leapyr

    leap year flag (none)
    0 leap year
    1 regular year

- integer parm::id1

    first day of simulation in current year (julian date)

- integer parm::mo_chk

    current month of simulation (none)

- integer parm::nhtot

    total number of relative humidity records in file

- integer parm::nstot

    total number of solar radiation records in file (none)

- integer parm::nwtot

    total number of wind speed records in file

- integer parm::ifirsts

    solar radiation data search code (none)
    0 first day of solar radiation data located in file
    1 first day of solar radiation data not located in file

- integer parm::ifirsth

relative humidity data search code (none)
0 first day of relative humidity data located in file
1 first day of relative humidity data not located in file

- integer parm::ifirstw

  wind speed data search code (none)
  0 first day of wind speed data located in file
  1 first day of wind speed data not located in file

- integer **parm::icst**
- integer parm::ilog

  streamflow print code (none)
  0 print streamflow in reach
  1 print Log10 streamflow in reach

- integer parm::itotr

  number of output variables printed (output.rch)

- integer parm::iyr

  current year of simulation (year)

- integer parm::iwq

  stream water quality code
  0 do not model stream water quality
  1 model stream water quality (QUAL2E & pesticide transformations)

- integer parm::iskip

  flag for calculations performed only for the first year of simulation (none)

- integer parm::ifirstpet

  potential ET data search code (none)
  0 first day of potential ET data located in file
  1 first day of potential ET data not located in file

- integer parm::iprp

  print code for output.pst file
  0 do not print pesticide output
  1 print pesticide output

- integer parm::itotb

  number of output variables printed (output.sub)

- integer parm::itots

  number of output variables printed (output.hru)

- integer parm::itoth

  number of HRUs printed (output.hru/output.wtr)

- integer parm::pcpsim

  rainfall input code (none)
  1 measured data read for each subbasin
  2 data simulated for each subbasin

- integer **parm::nd_30**
- integer **parm::iops**
- integer **parm::iphr**
- integer **parm::isto**
- integer **parm::isol**
- integer parm::fcstcycles

  number of times forecast period is simulated (using different weather generator seeds each time)

- integer parm::fcstday

  beginning date of forecast period (julian date)

- integer parm::fcstyr

  beginning year of forecast period

- integer parm::iscen

  scenarios counter

- integer parm::subtot

number of subbasins in watershed (none)

- integer **parm::ogen**
- integer parm::mapp

  maximum number of applications
- integer parm::mlyr

  maximum number of soil layers
- integer parm::mpst

  max number of pesticides used in wshed
- integer parm::mres

  maximum number of reservoirs
- integer parm::msub

  maximum number of subbasins
- integer parm::igen

  random number generator seed code (none):
  0: use default numbers
  1: generate new numbers in every simulation
- integer parm::iprint

  print code (none): 0=monthly, 1=daily, 2=annually
- integer parm::iida

  day being simulated (current julian date) (julian date)
- integer parm::icn

  CN method flag (for testing alternative method):
  0 use traditional SWAT method which bases CN on soil moisture
  1 use alternative method which bases CN on plant ET
  2 use tradtional SWAT method which bases CN on soil moisture but rention is adjusted for mildly-sloped tiled-drained watersheds.
- integer parm::ised_det

  max half-hour rainfall fraction calc option:
  0 generate max half-hour rainfall fraction from triangular distribution
  1 use monthly mean max half-hour rainfall fraction
- integer **parm::fcstcnt**
- integer **parm::mtran**
- integer **parm::idtill**
- integer, dimension(100) **parm::ida_lup**
- integer, dimension(100) **parm::iyr_lup**
- integer **parm::no_lup**
- integer **parm::no_up**
- integer **parm::nostep**
- character(len=8) parm::date

  date simulation is performed where leftmost eight characters are set to a value of yyyymmdd, where yyyy is the year, mm is the month and dd is the day
- character(len=10) parm::time

  time simulation is performed where leftmost ten characters are set to a value of hhmmss.sss, where hh is the hour, mm is the minutes and ss.sss is the seconds and milliseconds
- character(len=5) parm::zone

  time difference with respect to Coordinated Universal Time (ie Greenwich Mean Time)
- character(len=13) parm::calfile

  name of file containing calibration parameters
- character(len=13) parm::rhfile

  relative humidity file name (.hmd)
- character(len=13) parm::slrfile

  solar radiation file name (.slr)
- character(len=13) parm::wndfile

wind speed file name (.wnd)

- character(len=13) parm::petfile

  potential ET file name (.pet)
- character(len=13) **parm::atmofile**
- character(len=13) **parm::lucfile**
- character(len=13) parm::septdb

  name of septic tank database file (septwq1.dat)
- character(len=13) **parm::dpd_file**
- character(len=13) **parm::wpd_file**
- character(len=13) **parm::rib_file**
- character(len=13) **parm::sfb_file**
- character(len=13) **parm::lid_file**
- integer, dimension(9) parm::idg

  array location of random number seed used for a given process
- integer, dimension(:), allocatable **parm::ifirstr**
- integer, dimension(:), allocatable **parm::ifirsthr**
- integer, dimension(8) parm::values

  values(1): year simulation is performed
  values(2): month simulation is performed
  values(3): day in month simulation is performed
  values(4): time difference with respect to Coordinated Universal Time (ie Greenwich Mean Time)
  values(5): hour simulation is performed
  values(6): minute simulation is performed
  values(7): second simulation is performed
  values(8): millisecond simulation is performed
- integer, dimension(13) parm::ndays

  julian date for last day of preceding month (where the array location is the number of the month). The dates are for leap years (julian date)
- integer **parm::mapex**
- real ∗8, dimension(:), allocatable **parm::flodaya**
- real ∗8, dimension(:), allocatable **parm::seddaya**
- real ∗8, dimension(:), allocatable **parm::orgndaya**
- real ∗8, dimension(:), allocatable **parm::orgpdaya**
- real ∗8, dimension(:), allocatable **parm::no3daya**
- real ∗8, dimension(:), allocatable **parm::minpdaya**
- real ∗8, dimension(:), allocatable parm::hi_targ

  harvest index target of cover defined at planting ((kg/ha)/(kg/ha))
- real ∗8, dimension(:), allocatable parm::bio_targ

  biomass target (kg/ha)
- real ∗8, dimension(:), allocatable parm::tnyld

  modifier for autofertilization target nitrogen content for plant (kg N/kg yield)
- integer, dimension(:), allocatable **parm::idapa**
- integer, dimension(:), allocatable **parm::iypa**
- integer, dimension(:), allocatable **parm::ifirsta**
- integer, dimension(100) **parm::mo_transb**
- integer, dimension(100) **parm::mo_transe**
- integer, dimension(100) **parm::ih_tran**
- integer parm::msdb

  maximum number of sept wq data database (none)
- integer **parm::iseptic**
- real ∗8, dimension(:), allocatable parm::sptqs

  flow rate of the septic tank effluent per capita (m3/d)
- real ∗8, dimension(:), allocatable **parm::percp**
- real ∗8, dimension(:), allocatable parm::sptbodconcs

Biological Oxygen Demand of the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable parm::spttssconcs
  concentration of total suspended solid in the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable parm::spttnconcs
  concentration of total nitrogen in the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable parm::sptnh4concs
  concentration of total phosphorus of the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable parm::sptno3concs
  concentration of nitrate in the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable parm::sptno2concs
  concentration of nitrite in the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable parm::sptorgnconcs
  concentration of organic nitrogen in the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable parm::spttpconcs
  concentration of total phosphorus in the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable parm::sptminps
  concentration of mineral phosphorus in the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable parm::sptorgps
  concentration of organic phosphorus in the septic tank effluent (mg/l)
- real ∗8, dimension(:), allocatable parm::sptfcolis
  concentration of the facel caliform in the septic tank effluent (cfu/100ml)
- real ∗8, dimension(:), allocatable **parm::failyr**
- real ∗8, dimension(:), allocatable **parm::qstemm**
- real ∗8, dimension(:), allocatable parm::bio_bod
  BOD concentration in biozone (kg/ha)
- real ∗8, dimension(:), allocatable parm::biom
  biomass of live bacteria in biozone (kg/ha)
- real ∗8, dimension(:), allocatable parm::rbiom
  daily change in biomass of live bacteria (kg/ha)
- real ∗8, dimension(:), allocatable **parm::bio_amn**
- real ∗8, dimension(:), allocatable parm::fcoli
  concentration of the fecal coliform in the biozone septic tank effluent (cfu/100ml)
- real ∗8, dimension(:), allocatable **parm::bio_ntr**
- real ∗8, dimension(:), allocatable **parm::bz_perc**
- real ∗8, dimension(:), allocatable parm::sep_cap
  number of permanent residents in the hourse (none)
- real ∗8, dimension(:), allocatable parm::plqm
  plaque in biozone (kg/ha)
- real ∗8, dimension(:), allocatable **parm::bz_area**
- real ∗8, dimension(:), allocatable parm::bz_z
  depth of biozone layer (mm)
- real ∗8, dimension(:), allocatable parm::bz_thk
  thickness of biozone (mm)
- real ∗8, dimension(:), allocatable parm::bio_bd
  density of biomass (kg/m^3)
- real ∗8, dimension(:), allocatable parm::cmup_kgh
  current soil carbon for first soil layer (kg/ha)
- real ∗8, dimension(:), allocatable parm::cmtot_kgh
  current soil carbon integrated - aggregating (kg/ha)
- real ∗8, dimension(:), allocatable parm::coeff_denitr
  denitrification rate coefficient (none)

- real ∗8, dimension(:), allocatable parm::coeff_bod_dc
  BOD decay rate coefficient (m^3/day)
- real ∗8, dimension(:), allocatable parm::coeff_bod_conv
  BOD to live bacteria biomass conversion factor (none)
- real ∗8, dimension(:), allocatable parm::coeff_fc1
  field capacity calibration parameter 1 (none)
- real ∗8, dimension(:), allocatable parm::coeff_fc2
  field capacity calibration parameter 2 (none)
- real ∗8, dimension(:), allocatable parm::coeff_fecal
  fecal coliform bacteria decay rate coefficient (m^3/day)
- real ∗8, dimension(:), allocatable parm::coeff_mrt
  mortality rate coefficient (none)
- real ∗8, dimension(:), allocatable parm::coeff_nitr
  nitrification rate coefficient (none)
- real ∗8, dimension(:), allocatable parm::coeff_plq
  conversion factor for plaque from TDS (none)
- real ∗8, dimension(:), allocatable parm::coeff_rsp
  respiration rate coefficient (none)
- real ∗8, dimension(:), allocatable parm::coeff_slg1
  slough-off calibration parameter (none)
- real ∗8, dimension(:), allocatable parm::coeff_slg2
  slough-off calibration parameter (none)
- real ∗8, dimension(:), allocatable **parm::coeff_pdistrb**
- real ∗8, dimension(:), allocatable **parm::coeff_solpslp**
- real ∗8, dimension(:), allocatable **parm::coeff_solpintc**
- real ∗8, dimension(:), allocatable **parm::coeff_psorpmax**
- integer, dimension(:), allocatable parm::isep_typ
  septic system type (none)
- integer, dimension(:), allocatable parm::i_sep
  soil layer where biozone exists (none)
- integer, dimension(:), allocatable parm::isep_opt
  septic system operation flag (1=active, 2=failing, 3 or 0=not operated) (none)
- integer, dimension(:), allocatable **parm::sep_tsincefail**
- integer, dimension(:), allocatable **parm::isep_tfail**
- integer, dimension(:), allocatable **parm::isep_iyr**
- integer, dimension(:), allocatable **parm::sep_strm_dist**
- integer, dimension(:), allocatable **parm::sep_den**
- real ∗8, dimension(:), allocatable **parm::sol_sumno3**
- real ∗8, dimension(:), allocatable **parm::sol_sumsolp**
- real ∗8, dimension(:), allocatable **parm::strsw_sum**
- real ∗8, dimension(:), allocatable **parm::strstmp_sum**
- real ∗8, dimension(:), allocatable **parm::strsn_sum**
- real ∗8, dimension(:), allocatable **parm::strsp_sum**
- real ∗8, dimension(:), allocatable **parm::strsa_sum**
- real ∗8, dimension(:), allocatable **parm::spill_hru**
- real ∗8, dimension(:), allocatable **parm::tile_out**
- real ∗8, dimension(:), allocatable **parm::hru_in**
- real ∗8, dimension(:), allocatable **parm::spill_precip**
- real ∗8, dimension(:), allocatable **parm::pot_seep**
- real ∗8, dimension(:), allocatable **parm::pot_evap**
- real ∗8, dimension(:), allocatable **parm::pot_sedin**
- real ∗8, dimension(:), allocatable parm::pot_solp

soluble P loss rate in the pothole (.01 - 0.5) (1/d)

- real ∗8, dimension(:), allocatable **parm::pot_solpi**
- real ∗8, dimension(:), allocatable parm::pot_orgp

  amount of organic P in pothole water body (kg P)
- real ∗8, dimension(:), allocatable **parm::pot_orgpi**
- real ∗8, dimension(:), allocatable parm::pot_orgn

  amount of organic N in pothole water body (kg N)
- real ∗8, dimension(:), allocatable **parm::pot_orgni**
- real ∗8, dimension(:), allocatable parm::pot_mps

  amount of stable mineral pool P in pothole water body (kg N)
- real ∗8, dimension(:), allocatable **parm::pot_mpsi**
- real ∗8, dimension(:), allocatable parm::pot_mpa

  amount of active mineral pool P in pothole water body (kg N)
- real ∗8, dimension(:), allocatable **parm::pot_mpai**
- real ∗8, dimension(:), allocatable **parm::pot_no3i**
- real ∗8, dimension(:), allocatable **parm::precip_in**
- real ∗8, dimension(:), allocatable **parm::tile_sedo**
- real ∗8, dimension(:), allocatable **parm::tile_no3o**
- real ∗8, dimension(:), allocatable **parm::tile_solpo**
- real ∗8, dimension(:), allocatable **parm::tile_orgno**
- real ∗8, dimension(:), allocatable **parm::tile_orgpo**
- real ∗8, dimension(:), allocatable **parm::tile_minpso**
- real ∗8, dimension(:), allocatable **parm::tile_minpao**
- integer **parm::ia_b**
- integer **parm::ihumus**
- integer **parm::itemp**
- integer **parm::isnow**
- integer, dimension(46) parm::ipdvar

  output variable codes for output.rch file (none)
- integer, dimension(mhruo) parm::ipdvas

  output varaible codes for output.hru file (none)
- integer, dimension(msubo) parm::ipdvab

  output variable codes for output.sub file (none)
- integer, dimension(:), allocatable parm::ipdhru

  HRUs whose output information will be printed to the output.hru and output.wtr files.
- real ∗8, dimension(mstdo) parm::wshddayo

  wshddayo(1) average amountof precipitation in watershed for the day (mm H20)
  wshddayo(3) surface runoff in watershed for day (mm H20)
  wshddayo(4) lateral flow contribution to streamflow in watershed for day (mm H20)
  wshddayo(5) water percolation past bottom of soil profile in watershed for day (mm H20)
  wshddayo(6) water yield to streamflow from HRUs in watershed for day (mm H20)
  wshddayo(7) actual evapotranspiration in watershed for day (mm H20)
  wshddayo(8) average maximum temperature in watershed for the day (deg C)
  wshddayo(9) average minimum temperature in watershed for the day (deg C)
  wshddayo(12) sediment yield from HRUs in watershed for day (metric tons or metric tons/ha)
  wshddayo(13) sediment loading to ponds in watershed for day (metric tons)
  wshddayo(14) sediment loading from ponds in watershed for day (metric tons)
  wshddayo(15) net change in sediment level in ponds in watershed for day (metric tons)
  wshddayo(16) sediment loading to wetlands for day in watershed (metric tons)
  wshddayo(17) sediment loading to main channels from wetlands for day in watershed (metric tons)
  wshddayo(18) net change in sediment in wetlands for day in watershed (metric tons)
  wshddayo(19) evaporation from ponds in watershed for day (m^3 H2O)
  wshddayo(20) seepage from ponds in watershed for day (m^3 H2O)
  wshddayo(21) precipitation on ponds in watershed for day (m^3 H2O)
  wshddayo(22) volume of water entering ponds in watershed for day (m^3 H2O)
  wshddayo(23) volume of water leaving ponds in watershed for day (m^3 H2O)

wshddayo(24) evaporation from wetlands for day in watershed (m^3 H2O)
wshddayo(25) seepage from wetlands for day in watershed (m^3 H2O)
wshddayo(26) precipitation on wetlands for day in watershed (m^3 H2O)
wshddayo(27) volume of water entering wetlands on day in watershed (m^3 H2O)
wshddayo(28) volume of water leaving wetlands on day in watershed (m^3 H2O)
wshddayo(33) net change in water volume of ponds in watershed for day (m^3 H2O)
wshddayo(35) amount of water stored in soil profile in watershed at end of day (mm H20)
wshddayo(36) snow melt in watershed for day (mm H20)
wshddayo(37) sublimation in watershed for day (mm H20)
wshddayo(38) average amount of tributary channel transmission losses in watershed on day (mm H20)
wshddayo(39) freezing rain/snow fall in watershed for day (mm H20)
wshddayo(40) organic N loading to stream in watershed for day (kg N/ha)
wshddayo(41) organic P loading to stream in watershed for day (kg P/ha)
wshddayo(42) nitrate loading to stream in surface runoff in watershed for day (kg N/ha)
wshddayo(43) soluble P loading to stream in watershed for day (kg P/ha)
wshddayo(44) plant uptake of N in watershed for day (kg N/ha)
wshddayo(45) nitrate loading to stream in lateral flow in watershed for day (kg N/ha)
wshddayo(46) nitrate percolation past bottom of soil profile in watershed for day (kg N/ha)
wshddayo(104) groundwater contribution to stream in watershed on day (mm H20)
wshddayo(105) amount of water moving from shallow aquifer to plants/soil profile in watershed on day (mm H2O)
wshddayo(106) deep aquifer recharge in watershed on day (mm H2O)
wshddayo(107) total amount of water entering both aquifers in watershed on day (mm H2O)
wshddayo(108) potential evapotranspiration in watershed on day (mm H20)
wshddayo(109) drainage tile flow contribution to stream in watershed on day (mm H20)
wshddayo(110) NO3 yield (gwq) (kg/ha)
wshddayo(111) NO3 yield (tile) (mm H2O)

- real ∗8, dimension(mstdo) parm::wshdmono

  watershed monthly output array (see definitions for wshddayo array elements) (varies)
  wshdmono(1) average amount of precipitation in watershed for the month (mm H2O)
  wshdmono(3) surface runoff in watershed for month (mm H2O)
  wshdmono(4) lateral flow contribution to streamflow in watershed for month (mm H2O)
  wshdmono(5) water percolation past bottom of soil profile in watershed for month (mm H2O)
  wshdmono(6) water yield to streamflow from HRUs in watershed for month (mm H2O)
  wshdmono(7) actual evapotranspiration in watershed for month (mm H2O)
  wshdmono(8) average maximum temperature in watershed for the month (deg C)
  wshdmono(9) average minimum temperature in watershed for the month (deg C)
  wshdmono(12) sediment yield from HRUs in watershed for the month (metric tons)
  wshdmono(39) freezing rain/snow fall in watershed for the month (mm H2O)
  wshdmono(40) organic N loading to stream in watershed for the month (kg N/ha)
  wshdmono(41) organic P loading to stream in watershed for the month (kg P/ha)
  wshdmono(42) nitrate loading to stream in surface runoff in watershed for the month (kg N/ha)
  wshdmono(43) soluble P loading to stream in watershed for the month (kg P/ha)
  wshdmono(44) plant uptake of N in watershed for the month (kg N/ha)
  wshdmono(45) nitrate loading to stream in lateral flow in watershed for the month (kg N/ha)
  wshdmono(46) nitrate percolation past bottom of soil profile in watershed for the month (kg N/ha)
  wshdmono(104) groundwater contribution to stream in watershed for the month (mm H2O)
  wshdmono(108) potential evapotranspiration in watershed for the month (mm H2O)
  wshdmono(109) drainage tile flow contribution to stream in watershed for the month (mm H2O)

- real ∗8, dimension(mstdo) parm::wshdyro

  watershed annual output array (varies)
  wshdyro(1) average amount of precipitation in watershed for the year (mm H2O)
  wshdyro(3) surface runoff in watershed for year (mm H2O)
  wshdyro(4) lateral flow contribution to streamflow in watershed for year (mm H2O)
  wshdyro(5) water percolation past bottom of soil profile in watershed for year (mm H2O)
  wshdyro(6) water yield to streamflow from HRUs in watershed for year (mm H2O)
  wshdyro(7) actual evapotranspiration in watershed for year (mm H2O)
  wshdyro(8) average maximum temperature in watershed for the year (deg C)
  wshdyro(9) average minimum temperature in watershed for the year (deg C)
  wshdyro(12) sediment yield from HRUs in watershed for the year (metric tons)
  wshdyro(40) organic N loading to stream in watershed for the year (kg N/ha)
  wshdyro(41) organic P loading to stream in watershed for the year (kg P/ha)
  wshdyro(42) nitrate loading to stream in surface runoff in watershed for the year (kg N/ha)
  wshdyro(43) soluble P loading to stream in watershed for the year (kg P/ha)

wshdyro(44) plant uptake of N in watershed for the year
wshdyro(45) nitrate loading to stream in lateral flow in watershed for the year (kg N/ha)
wshdyro(46) nitrate percolation past bottom of soil profile in watershed for the year (kg N/ha)
wshdyro(104) groundwater contribution to stream in watershed for the year (mm H2O)
wshdyro(108) potential evapotranspiration in watershed for the year (mm H2O)
wshdyro(109) drainage tile flow contribution to stream in watershed for the year (mm H2O)

- real ∗8, dimension(16) **parm::fcstaao**
- real ∗8, dimension(mstdo) parm::wshdaao

  watershed average annual output array (varies)
  wshdaao(1) precipitation in watershed (mm H2O)
  wshdaao(3) surface runoff loading to main channel in watershed (mm H2O)
  wshdaao(4) lateral flow loading to main channel in watershed (mm H2O)
  wshdaao(5) percolation of water out of root zone in watershed (mm H2O)
  wshdaao(7) actual evapotranspiration in watershed (mm H2O)
  wshdaao(13) sediment loading to ponds in watershed (metric tons)
  wshdaao(14) sediment loading from ponds in watershed (metric tons)
  wshdaao(15) net change in sediment level in ponds in watershed (metric tons)
  wshdaao(19) evaporation from ponds in watershed (m^3 H2O)
  wshdaao(20) seepage from ponds in watershed (m^3 H2O)
  wshdaao(21) precipitation on ponds in watershed (m^3 H2O)
  wshdaao(22) volume of water entering ponds in watershed (m^3 H2O)
  wshdaao(23) volume of water leaving ponds in watershed (m^3 H2O)
  wshdaao(38) transmission losses in watershed (mm H2O)
- real ∗8, dimension(:,:), allocatable parm::wpstdayo

  wpstdayo(1,:) amount of pesticide type in surface runoff contribution to stream in watershed on day (in solution) (mg pst/ha)
  wpstdayo(2,:) amount of pesticide type in surface runoff contribution to stream in watershed on day (sorbed to sediment) (mg pst/ha)
  wpstdayo(3,:) amount of pesticide type leached from soil profile in watershed on day (kg pst/ha)
  wpstdayo(4,:) amount of pesticide type in lateral flow contribution to stream in watershed on day (kg pst/ha)
- real ∗8, dimension(:,:), allocatable **parm::wpstmono**
- real ∗8, dimension(:,:), allocatable **parm::wpstyro**
- real ∗8, dimension(:,:), allocatable parm::bio_hv

  harvested biomass (dry weight) (kg/ha)
- real ∗8, dimension(:,:), allocatable parm::yldkg

  yield (dry weight) by crop type in the HRU (kg/ha)
- real ∗8, dimension(:,:), allocatable parm::rchmono

  reach monthly output array (varies)
  rchmono(1,:) flow into reach during month (m^3/s)
  rchmono(2,:) flow out of reach during month (m^3/s)
  rchmono(3,:) sediment transported into reach during month (metric tons)
  rchmono(4,:) sediment transported out of reach during month (metric tons)
  rchmono(5,:) sediment concentration in outflow during month (mg/L)
  rchmono(6,:) organic N transported into reach during month (kg N)
  rchmono(7,:) organic N transported out of reach during month (kg N)
  rchmono(8,:) organic P transported into reach during month (kg P)
  rchmono(9,:) organic P transported out of reach during month (kg P)
  rchmono(10,:) evaporation from reach during month (m^3/s)
  rchmono(11,:) transmission losses from reach during month (m^3/s)
  rchmono(12,:) conservative metal #1 transported out of reach during month (kg)
  rchmono(13,:) conservative metal #2 transported out of reach during month (kg)
  rchmono(14,:) conservative metal #3 transported out of reach during month (kg)
  rchmono(15,:) nitrate transported into reach during month (kg N)
  rchmono(16,:) nitrate transported out of reach during month (kg N)
  rchmono(17,:) soluble P transported into reach during month (kg P)
  rchmono(18,:) soluble P transported out of reach during month (kg P)
  rchmono(19,:) soluble pesticide transported into reach during month (mg pst)
  rchmono(20,:) soluble pesticide transported out of reach during month (mg pst)
  rchmono(21,:) sorbed pesticide transported into reach during month (mg pst)
  rchmono(22,:) sorbed pesticide transported out of reach during month (mg pst)
  rchmono(23,:) amount of pesticide lost through reactions in reach during month (mg pst)

rchmono(24,:) amount of pesticide lost through volatilization from reach during month (mg pst)
rchmono(25,:) amount of pesticide settling out of reach to bed sediment during month (mg pst)
rchmono(26,:) amount of pesticide resuspended from bed sediment to reach during month (mg pst)
rchmono(27,:) amount of pesticide diffusing from reach to bed sediment during month (mg pst)
rchmono(28,:) amount of pesticide in sediment layer lost through reactions during month (mg pst)
rchmono(29,:) amount of pesticide in sediment layer lost through burial during month (mg pst)
rchmono(30,:) chlorophyll-a transported into reach during month (kg chla)
rchmono(31,:) chlorophyll-a transported out of reach during month (kg chla)
rchmono(32,:) ammonia transported into reach during month (kg N)
rchmono(33,:) ammonia transported out of reach during month (kg N)
rchmono(34,:) nitrite transported into reach during month (kg N)
rchmono(35,:) nitrite transported out of reach during month (kg N)
rchmono(36,:) CBOD transported into reach during month (kg O2)
rchmono(37,:) CBOD transported out of reach during month (kg O2)
rchmono(38,:) dissolved oxygen transported into reach during month (kg O2)
rchmono(39,:) dissolved oxygen transported out of reach during month (kg O2)
rchmono(40,:) persistent bacteria transported out of reach during month (kg bact)
rchmono(41,:) less persistent bacteria transported out of reach during month (kg bact)
rchmono(43,:) total N (org N + no3 + no2 + nh4 outs) (kg)
rchmono(44,:) total P (org P + sol p outs) (kg)

- real ∗8, dimension(:,:), allocatable parm::rchyro

reach annual output array (varies)
rchyro(1,:) flow into reach during year (m^3/s)
rchyro(2,:) flow out of reach during year (m^3/s)
rchyro(3,:) sediment transported into reach during year (metric tons)
rchyro(4,:) sediment transported out of reach during year (metric tons)
rchyro(5,:) sediment concentration in outflow during year (mg/L)
rchyro(6,:) organic N transported into reach during year (kg N)
rchyro(7,:) organic N transported out of reach during year (kg N)
rchyro(8,:) organic P transported into reach during year (kg P)
rchyro(9,:) organic P transported out of reach during year (kg P)
rchyro(10,:) evaporation from reach during year (m^3/s)
rchyro(11,:) transmission losses from reach during year (m^3/s)
rchyro(12,:) conservative metal #1 transported out of reach during year (kg)
rchyro(13,:) conservative metal #2 transported out of reach during year (kg)
rchyro(14,:) conservative metal #3 transported out of reach during year (kg)
rchyro(15,:) nitrate transported into reach during year (kg N)
rchyro(16,:) nitrate transported out of reach during year (kg N)
rchyro(17,:) soluble P transported into reach during year (kg P)
rchyro(18,:) soluble P transported out of reach during year (kg P)
rchyro(19,:) soluble pesticide transported into reach during year (mg pst)
rchyro(20,:) soluble pesticide transported out of reach during year (mg pst)
rchyro(21,:) sorbed pesticide transported into reach during year (mg pst)
rchyro(22,:) sorbed pesticide transported out of reach during year (mg pst)
rchyro(23,:) amount of pesticide lost through reactions in reach during year!> (mg pst)
rchyro(24,:) amount of pesticide lost through volatilization from reach during year (mg pst)
rchyro(25,:) amount of pesticide settling out of reach to bed sediment during year (mg pst)
rchyro(26,:) amount of pesticide resuspended from bed sediment to reach during year (mg pst)
rchyro(27,:) amount of pesticide diffusing from reach to bed sediment during year (mg pst)
rchyro(28,:) amount of pesticide in sediment layer lost through reactions during year (mg pst)
rchyro(29,:) amount of pesticide in sediment layer lost through burial during year (mg pst)
rchyro(30,:) chlorophyll-a transported into reach during year (kg chla)
rchyro(31,:) chlorophyll-a transported out of reach during year (kg chla)
rchyro(32,:) ammonia transported into reach during year (kg N)
rchyro(33,:) ammonia transported out of reach during year (kg N)
rchyro(34,:) nitrite transported into reach during year (kg N)
rchyro(35,:) nitrite transported out of reach during year (kg N)
rchyro(36,:) CBOD transported into reach during year (kg O2)
rchyro(37,:) CBOD transported out of reach during year (kg O2)
rchyro(38,:) dissolved oxygen transported into reach during year (kg O2)
rchyro(39,:) dissolved oxygen transported out of reach during year (kg O2)
rchyro(40,:) persistent bacteria transported out of reach during year (kg bact)
rchyro(41,:) less persistent bacteria transported out of reach during year (kg bact)

- real ∗8, dimension(:,:), allocatable **parm::wpstaao**
- real ∗8, dimension(:,:), allocatable parm::hrumono

  HRU monthly output data array (varies)
  hrumono(1,:) precipitation in HRU during month (mm H2O)
  hrumono(2,:) amount of precipitation falling as freezing rain/snow in HRU during month (mm H2O)
  hrumono(3,:) amount of snow melt in HRU during month (mm H2O)
  hrumono(4,:) amount of surface runoff to main channel from HRU during month (ignores impact of transmission losses) (mm H2O)
  hrumono(5,:) amount of lateral flow contribution to main channel from HRU during month (mm H2O)
  hrumono(6,:) amount of groundwater flow contribution to main channel from HRU during month (mm H2O)
  hrumono(7,:) amount of water moving from shallow aquifer to plants or soil profile in HRU during mont (mm H2O)h
  hrumono(8,:) amount of water recharging deep aquifer in HRU during month (mm H2O)
  hrumono(9,:) total amount of water entering both aquifers from HRU during month (mm H2O)
  hrumono(10,:) water yield (total amount of water entering main channel) from HRU during month (mm H2O)
  hrumono(11,:) amount of water percolating out of the soil profile and into the vadose zone in HRU during month (mm H2O)
  hrumono(12,:) actual evapotranspiration in HRU during month (mm H2O)
  hrumono(13,:) amount of transmission losses from tributary channels in HRU for month (mm H2O)
  hrumono(14,:) sediment yield from HRU for month (metric tons/ha)
  hrumono(15,:) actual amount of transpiration that occurs during month in HRU (mm H2O)
  hrumono(16,:) actual amount of evaporation (from soil) that occurs during month in HRU (mm H2O)
  hrumono(17,:) amount of nitrogen applied in continuous fertilizer operation during month in HRU (kg N/ha)
  hrumono(18,:) amount of phosphorus applied in continuous fertilizer operation during month in HRU (kg P/ha)
  hrumono(19,:) amount of surface runoff generated during month in HRU (mm H2O)
  hrumono(20,:) CN values during month in HRU (none)
  hrumono(21,:) sum of daily soil water values used to calculate the curve number (mm H2O)
  hrumono(22,:) amount of irrigation water applied to HRU during month (mm H2O)
  hrumono(23,:) amount of water removed from shallow aquifer in HRU for irrigation during month (mm H2O)
  hrumono(24,:) amount of water removed from deep aquifer in HRU for irrigation during month (mm H2O)
  hrumono(25,:) potential evapotranspiration in HRU during month (mm H2O)
  hrumono(26,:) monthly amount of N (organic & mineral) applied in HRU during grazing (kg N/ha)
  hrumono(27,:) monthly amount of P (organic & mineral) applied in HRU during grazing (kg P/ha)
  hrumono(28,:) monthly amount of N (organic & mineral) auto-applied in HRU (kg N/ha)
  hrumono(29,:) monthly amount of P (organic & mineral) auto-applied in HRU (kg P/ha)
  hrumono(30,:) sum of daily soil temperature values (deg C) hrumono(31,:) water stress days in HRU during month (stress days)
  hrumono(32,:) temperature stress days in HRU during month (stress days)
  hrumono(33,:) nitrogen stress days in HRU during month (stress days)
  hrumono(34,:) phosphorus stress days in HRU during month (stress days)
  hrumono(35,:) organic nitrogen in surface runoff in HRU during month (kg N/ha)
  hrumono(36,:) organic phosphorus in surface runoff in HRU during month (kg P/ha)
  hrumono(37,:) nitrate in surface runoff in HRU during month (kg N/ha)
  hrumono(38,:) nitrate in lateral flow in HRU during month (kg N/ha)
  hrumono(39,:) soluble phosphorus in surface runoff in HRU during month (kg P/ha)
  hrumono(40,:) amount of nitrogen removed from soil by plant uptake in HRU during month (kg N/ha)
  hrumono(41,:) nitrate percolating past bottom of soil profile in HRU during month (kg N/ha)
  hrumono(42,:) amount of phosphorus removed from soil by plant uptake in HRU during month (kg P/ha)
  hrumono(43,:) amount of phosphorus moving from labile mineral to active mineral pool in HRU during month (kg P/ha)
  hrumono(44,:) amount of phosphorus moving from active mineral to stable mineral pool in HRU during month (kg P/ha)
  hrumono(45,:) amount of nitrogen applied to HRU in fertilizer and grazing operations during month (kg N/ha)
  hrumono(46,:) amount of phosphorus applied to HRU in fertilizer and grazing operations during month (kg P/ha)
  hrumono(47,:) amount of nitrogen added to soil by fixation in HRU during month (kg N/ha)
  hrumono(48,:) amount of nitrogen lost by denitrification in HRU during month (kg N/ha)
  hrumono(49,:) amount of nitrogen moving from active organic to nitrate pool in HRU during month (kg N/ha)
  hrumono(50,:) amount of nitrogen moving from active organic to stable organic pool in HRU during month (kg N/ha)
  hrumono(51,:) amount of phosphorus moving from organic to labile mineral pool in HRU during month (kg P/ha)
  hrumono(52,:) amount of nitrogen moving from fresh organic to nitrate and active organic pools in HRU during month (kg N/ha)
  hrumono(53,:) amount of phosphorus moving from fresh organic to the labile mineral and organic pools in HRU during month (kg P/ha)
  hrumono(54,:) amount of nitrogen added to soil in rain (kg N/ha)

hrumono(61,:) daily soil loss predicted with USLE equation (metric tons/ha)
hrumono(62,:) drainage tile flow contribution to main channel from HRU in month (mm H2O)
hrumono(63,:) less persistent bacteria transported to main channel from HRU during month (bacteria/ha)
hrumono(64,:) persistent bacteria transported to main channel from HRU during month (bacteria/ha)
hrumono(65,:) nitrate loading from groundwater in HRU to main channel during month (kg N/ha)
hrumono(66,:) soluble P loading from groundwater in HRU to main channel during month (kg P/ha)
hrumono(67,:) loading of mineral P attached to sediment in HRU to main channel during month (kg P/ha)

- real ∗8, dimension(:,:), allocatable parm::rchdy

rchdy(1,:) flow into reach on day (m^3/s)
rchdy(2,:) flow out of reach on day (m^3/s)
rchdy(3,:) evaporation from reach on day (m^3/s)
rchdy(4,:) transmission losses from reach on day (m^3/s)
rchdy(5,:) sediment transported into reach on day (metric tons)
rchdy(6,:) sediment transported out of reach on day (metric tons)
rchdy(7,:) sediment concentration in outflow (mg/L)
rchdy(8,:) organic N transported into reach on day (kg N)
rchdy(9,:) organic N transported out of reach on day (kg N)
rchdy(10,:) organic P transported into reach on day (kg P)
rchdy(11,:) organic P transported out of reach on day (kg P)
rchdy(12,:) nitrate transported into reach on day (kg N)
rchdy(13,:) nitrate transported out of reach on day (kg N)
rchdy(14,:) ammonia transported into reach on day (kg N)
rchdy(15,:) ammonia transported out of reach on day (kg N)
rchdy(16,:) nitrite transported into reach on day (kg N)
rchdy(17,:) nitrite transported out of reach on day (kg N)
rchdy(18,:) soluble P transported into reach on day (kg P)
rchdy(19,:) soluble P transported out of reach on day (kg P)
rchdy(20,:) chlorophyll-a transported into reach on day (kg chla)
rchdy(21,:) chlorophyll-a transported out of reach on day (kg chla)
rchdy(22,:) CBOD transported into reach on day (kg O2)
rchdy(23,:) CBOD transported out of reach on day (kg O2)
rchdy(24,:) dissolved oxygen transported into reach on day (kg O2)
rchdy(25,:) dissolved oxygen transported out of reach on day (kg O2)
rchdy(26,:) soluble pesticide transported into reach on day (mg pst)
rchdy(27,:) soluble pesticide transported out of reach o day (mg pst)
rchdy(28,:) sorbed pesticide transported into reach on day (mg pst)
rchdy(29,:) sorbed pesticide transported out of reach on day (mg pst)
rchdy(30,:) amount of pesticide lost through reactions in reach on day (mg pst)
rchdy(31,:) amount of pesticide lost through volatilization from reach on day (mg pst)
rchdy(32,:) amount of pesticide settling out of reach to bed sediment on day (mg pst)
rchdy(33,:) amount of pesticide resuspended from bed sediment to reach on day (mg pst)
rchdy(34,:) amount of pesticide diffusing from reach to bed sediment on day (mg pst)
rchdy(35,:) amount of pesticide in sediment layer lost through reactions on day (mg pst)
rchdy(36,:) amount of pesticide in sediment layer lost through burial on day (mg pst)
rchdy(37,:) amount of pesticide stored in river bed sediments (mg pst)
rchdy(38,:) persistent bacteria transported out of reach on day (kg bact)
rchdy(39,:) less persistent bacteria transported out of reach on day (kg bact)
rchdy(40,:) amount of conservative metal #1 transported out of reach on day (kg)
rchdy(41,:) amount of conservative metal #2 transported out of reach on day (kg)
rchdy(42,:) amount of conservative metal #3 transported out of reach on day (kg)
rchdy(43,:) total N (org N + no3 + no2 + nh4 outs) (kg)
rchdy(44,:) total P (org P + sol p outs) (kg)

- real ∗8, dimension(:,:), allocatable parm::hruyro

HRU annual output array (varies) hruyro(1,:) precipitation in HRU during year (mm H2O)
hruyro(2,:) amount of precipitation falling as freezing rain/snow in HRU during year (mm H2O)
hruyro(3,:) amount of snow melt in HRU during year (mm H2O)
hruyro(4,:) amount of surface runoff to main channel from HRU during year (ignores impact of transmission losses) (mm H2O)
hruyro(5,:) amount of lateral flow contribution to main channel from HRU during year (mm H2O)
hruyro(6,:) amount of groundwater flow contribution to main channel from HRU during year (mm H2O)
hruyro(7,:) amount of water moving from shallow aquifer to plants or soil profile in HRU during year (mm H2O)
hruyro(8,:) amount of water recharging deep aquifer in HRU during year (mm H2O)
hruyro(9,:) total amount of water entering both aquifers from HRU during year (mm H2O)

hruyro(10,:) water yield (total amount of water entering main channel) from HRU during year (mm H2O)
hruyro(11,:) amount of water percolating out of the soil profile and into the vadose zone in HRU during year (mm H2O)
hruyro(12,:) actual evapotranspiration in HRU during year (mm H2O)
hruyro(13,:) amount of transmission losses from tributary channels in HRU for year (mm H2O)
hruyro(14,:) sediment yield from HRU for year (metric tons/ha)
hruyro(15,:) actual amount of transpiration that occurs during year in HRU (mm H2O)
hruyro(16,:) actual amount of evaporation (from soil) that occurs during year in HRU (mm H2O)
hruyro(17,:) amount of nitrogen applied in continuous fertilizer operation during year in HRU (kg N/ha)
hruyro(18,:) amount of phosphorus applied in continuous fertilizer operation during year in HRU (kg P/ha)
hruyro(23,:) amount of water removed from shallow aquifer in HRU for irrigation during year (mm H2O)
hruyro(24,:) amount of water removed from deep aquifer in HRU for irrigation during year (mm H2O)
hruyro(25,:) potential evapotranspiration in HRU during year (mm H2O)
hruyro(26,:) annual amount of N (organic & mineral) applied in HRU during grazing (kg N/ha)
hruyro(27,:) annual amount of P (organic & mineral) applied in HRU during grazing (kg P/ha)
hruyro(28,:) annual amount of N (organic & mineral) auto-applied in HRU (kg N/ha)
hruyro(29,:) annual amount of P (organic & mineral) auto-applied in HRU (kg P/ha)
hruyro(31,:) water stress days in HRU during year (stress days)
hruyro(32,:) temperature stress days in HRU during year (stress days)
hruyro(33,:) nitrogen stress days in HRU during year (stress days)
hruyro(34,:) phosphorus stress days in HRU during year (stress days)
hruyro(35,:) organic nitrogen in surface runoff in HRU during year (kg N/ha)
hruyro(36,:) organic phosphorus in surface runoff in HRU during year (kg P/ha)
hruyro(37,:) nitrate in surface runoff in HRU during year (kg N/ha)
hruyro(38,:) nitrate in lateral flow in HRU during year (kg N/ha)
hruyro(39,:) soluble phosphorus in surface runoff in HRU during year (kg P/ha)
hruyro(40,:) amount of nitrogen removed from soil by plant uptake in HRU during year (kg N/ha)
hruyro(41,:) nitrate percolating past bottom of soil profile in HRU during year (kg N/ha)
hruyro(42,:) amount of phosphorus removed from soil by plant uptake in HRU during year (kg P/ha)
hruyro(43,:) amount of phosphorus moving from labile mineral to active mineral pool in HRU during year (kg P/ha)
hruyro(44,:) amount of phosphorus moving from active mineral to stable mineral pool in HRU during year (kg P/ha)
hruyro(45,:) amount of nitrogen applied to HRU in fertilizer and grazing operations during year (kg N/ha)
hruyro(46,:) amount of phosphorus applied to HRU in fertilizer and grazing operations during year (kg P/ha)
hruyro(47,:) amount of nitrogen added to soil by fixation in HRU during year (kg N/ha)
hruyro(48,:) amount of nitrogen lost by denitrification in HRU during year (kg N/ha)
hruyro(49,:) amount of nitrogen moving from active organic to nitrate pool in HRU during year (kg N/ha)
hruyro(50,:) amount of nitrogen moving from active organic to stable organic pool in HRU during year (kg N/ha)
hruyro(51,:) amount of phosphorus moving from organic to labile mineral pool in HRU during year (kg P/ha)
hruyro(52,:) amount of nitrogen moving from fresh organic to nitrate and active organic pools in HRU during year (kg N/ha)
hruyro(53,:) amount of phosphorus moving from fresh organic to the labile mineral and organic pools in HRU during year (kg P/ha)
hruyro(54,:) amount of nitrogen added to soil in rain during year (kg N/ha)
hruyro(61,:) daily soil loss predicted with USLE equation (metric tons/ha)
hruyro(63,:) less persistent bacteria transported to main channel from HRU during year (# bacteria/ha)
hruyro(64,:) persistent bacteria transported to main channel from HRU during year (# bacteria/ha)
hruyro(65,:) nitrate loading from groundwater in HRU to main channel during year (kg N/ha)
hruyro(66,:) soluble P loading from groundwater in HRU to main channel during year (kg P/ha)
hruyro(67,:) loading of mineral P attached to sediment in HRU to main channel during year (kg P/ha)

- real ∗8, dimension(:,:), allocatable parm::rchaao

reach average annual output array (varies)
rchaao(1,:) flow into reach during simulation (m^3/s)
rchaao(2,:) flow out of reach during simulation (m^3/s)
rchaao(3,:) sediment transported into reach during simulation (metric tons)
rchaao(4,:) sediment transported out of reach during simulation (metric tons)
rchaao(5,:) sediment concentration in outflow during simulation (mg/L)
rchaao(6,:) organic N transported into reach during simulation (kg N)
rchaao(7,:) organic N transported out of reach during simulation (kg N)
rchaao(8,:) organic P transported into reach during simulation (kg P)
rchaao(9,:) organic P transported out of reach during simulation (kg P)
rchaao(10,:) evaporation from reach during simulation (m^3/s)
rchaao(11,:) transmission losses from reach during simulation (m^3/s)
rchaao(12,:) conservative metal #1 transported out of reach during simulation (kg)

rchaao(13,:) conservative metal #2 transported out of reach during simulation (kg)
rchaao(14,:) conservative metal #3 transported out of reach during simulation (kg)
rchaao(15,:) nitrate transported into reach during simulation (kg N)
rchaao(16,:) nitrate transported out of reach during simulation (kg N)
rchaao(17,:) soluble P transported into reach during simulation (kg P)
rchaao(18,:) soluble P transported out of reach during simulation (kg P)
rchaao(19,:) soluble pesticide transported into reach during simulation
rchaao(20,:) soluble pesticide transported out of reach during simulation
rchaao(21,:) sorbed pesticide transported into reach during simulation
rchaao(22,:) sorbed pesticide transported out of reach during simulation
rchaao(23,:) amount of pesticide lost through reactions in reach during simulation
rchaao(24,:) amount of pesticide lost through volatilization from reach during simulation
rchaao(25,:) amount of pesticide settling out of reach to bed sediment during simulation
rchaao(26,:) amount of pesticide resuspended from bed sediment to reach during simulation
rchaao(27,:) amount of pesticide diffusing from reach to bed sediment during simulation
rchaao(28,:) amount of pesticide in sediment layer lost through reactions during simulation
rchaao(29,:) amount of pesticide in sediment layer lost through burial during simulation
rchaao(30,:) chlorophyll-a transported into reach during simulation (kg chla)
rchaao(31,:) chlorophyll-a transported out of reach during simulation (kg chla)
rchaao(32,:) ammonia transported into reach during simuation (kg N)
rchaao(33,:) ammonia transported out of reach during simuation (kg N)
rchaao(34,:) nitrite transported into reach during simuation (kg N)
rchaao(35,:) nitrite transported out of reach during simuation (kg N)
rchaao(36,:) CBOD transported into reach during simulation (kg O2)
rchaao(37,:) CBOD transported out of reach during simuation (kg O2)
rchaao(38,:) dissolved oxygen transported into reach during simuation (kg O2)
rchaao(39,:) dissolved oxygen transported out of reach during simulation (kg O2)
rchaao(40,:) persistent bacteria transported out of reach during simulation (kg bact)
rchaao(41,:) less persistent bacteria transported out of reach during simulation (kg bact)
rchaao(43,:) Total N (org N + no3 + no2 + nh4 outs) (kg)
rchaao(44,:) Total P (org P + sol p outs) (kg)

- real ∗8, dimension(:,:), allocatable parm::submono

  subbasin monthly output array (varies)
  submono(1,:) precipitation in subbasin for month (mm H20)
  submono(2,:) snow melt in subbasin for month (mm H20)
  submono(3,:) surface runoff loading in subbasin for month (mm H20)
  submono(4,:) water yield from subbasin for month (mm H20)
  submono(5,:) potential evapotranspiration in subbasin for month (mm H20)
  submono(6,:) actual evapotranspiration in subbasin for month (mm H20)
  submono(7,:) sediment yield from subbasin for month (metric tons/ha)
  submono(8,:) organic N loading from subbasin for month (kg N/ha)
  submono(9,:) organic P loading from subbasin for month (kg P/ha)
  submono(10,:) NO3 loading from surface runoff in subbasin for month (kg N/ha)
  submono(11,:) soluble P loading from subbasin for month (kg P/ha)
  submono(12,:) groundwater loading from subbasin for month (mm H20)
  submono(13,:) percolation out of soil profile in subbasin for month (mm H20)
  submono(14,:) loading to reach of mineral P attached to sediment from subbasin for month (kg P/ha)

- real ∗8, dimension(:,:), allocatable parm::subyro

  subbasin annual output array (varies)
  subyro(1,:) precipitation in subbasin for year (mm H2O)
  subyro(2,:) snow melt in subbasin for year (mm H2O)
  subyro(3,:) surface runoff loading in subbasin for year (mm H2O)
  subyro(4,:) water yield from subbasin for year (mm H2O)
  subyro(5,:) potential evapotranspiration in subbasin for year (mm H2O)
  subyro(6,:) actual evapotranspiration in subbasin for year (mm H2O)
  subyro(7,:) sediment yield from subbasin for year (metric tons/ha)
  subyro(8,:) organic N loading from subbasin for year (kg N/ha)
  subyro(9,:) organic P loading from subbasin for year (kg P/ha)
  subyro(10,:) NO3 loading from surface runoff in subbasin for year (kg N/ha)
  subyro(11,:) soluble P loading from subbasin for year (kg P/ha)
  subyro(12,:) groundwater loading from subbasin for year (mm H2O)
  subyro(13,:) percolation out of soil profile in subbasin for year (mm H2O)
  subyro(14,:) loading to reach of mineral P attached to sediment from subbasin for year (kg P/ha)

- real ∗8, dimension(:,:), allocatable parm::hruaao

  HRU average annual output array (varies)
  hruaao(1,:) precipitation in HRU during simulation (mm H2O)
  hruaao(2,:) amount of precipitation falling as freezing rain/snow in HRU during simulation (mm H2O)
  hruaao(3,:) amount of snow melt in HRU during simulation (mm H2O)
  hruaao(4,:) amount of surface runoff to main channel from HRU during simulation (ignores impact of transmission losses) (mm H2O)
  hruaao(5,:) amount of lateral flow contribution to main channel from HRU during simulation (mm H2O)
  hruaao(6,:) amount of groundwater flow contribution to main channel from HRU during simulation (mm H2O)
  hruaao(7,:) amount of water moving from shallow aquifer to plants or soil profile in HRU during simulation (mm H2O)
  hruaao(8,:) amount of water recharging deep aquifer in HRU during simulation (mm H2O)
  hruaao(9,:) total amount of water entering both aquifers from HRU during simulation (mm H2O)
  hruaao(10,:) water yield (total amount of water entering main channel) from HRU during simulation (mm H2O)
  hruaao(11,:) amount of water percolating out of the soil profile and into the vadose zone in HRU during simulation (mm H2O)
  hruaao(12,:) actual evapotranspiration in HRU during simulation
  hruaao(13,:) amount of transmission losses from tributary channels in HRU for simulation (mm H2O)
  hruaao(14,:) sediment yield from HRU for simulation (metric tons/ha)
  hruaao(17,:) amount of nitrogen applied in continuous fertilizer operation in HRU for simulation (kg N/ha)
  hruaao(18,:) amount of phosphorus applied in continuous fertilizer operation in HRU for simulation (kg P/ha)
  hruaao(23,:) amount of water removed from shallow aquifer in HRU for irrigation during simulation (mm H2O)
  hruaao(24,:) amount of water removed from deep aquifer in HRU for irrigation during simulation (mm H2O)
  hruaao(25,:) potential evapotranspiration in HRU during simulation (mm H2O)
  hruaao(26,:) annual amount of N (organic & mineral) applied in HRU during grazing (kg N/ha)
  hruaao(27,:) annual amount of P (organic & mineral) applied in HRU during grazing (kg P/ha)
  hruaao(28,:) average annual amount of N (organic & mineral) auto-applied in HRU (kg N/ha)
  hruaao(29,:) average annual amount of P (organic & mineral) auto-applied in HRU (kg P/ha)
  hruaao(31,:) water stress days in HRU during simulation (stress days)
  hruaao(32,:) temperature stress days in HRU during simulation (stress days)
  hruaao(33,:) nitrogen stress days in HRU during simulation (stress days)
  hruaao(34,:) phosphorus stress days in HRU during simulation (stress days)
  hruaao(35,:) organic nitrogen in surface runoff in HRU during simulation (kg N/ha)
  hruaao(36,:) organic phosphorus in surface runoff in HRU during simulation (kg P/ha)
  hruaao(37,:) nitrate in surface runoff in HRU during simulation (kg N/ha)
  hruaao(38,:) nitrate in lateral flow in HRU during simulation (kg N/ha)
  hruaao(39,:) soluble phosphorus in surface runoff in HRU during simulation (kg P/ha)
  hruaao(40,:) amount of nitrogen removed from soil by plant uptake in HRU during simulation (kg N/ha)
  hruaao(41,:) nitrate percolating past bottom of soil profile in HRU during simulation (kg N/ha)
  hruaao(42,:) amount of phosphorus removed from soil by plant uptake in HRU during simulation (kg P/ha)
  hruaao(43,:) amount of phosphorus moving from labile mineral to active mineral pool in HRU during simulation (kg P/ha)
  hruaao(44,:) amount of phosphorus moving from active mineral to stable mineral pool in HRU during simulation (kg P/ha)
  hruaao(45,:) amount of nitrogen applied to HRU in fertilizer and grazing operations during simulation (kg N/ha)
  hruaao(46,:) amount of phosphorus applied to HRU in fertilizer and grazing operations during simulation (kg P/ha)
  hruaao(47,:) amount of nitrogen added to soil by fixation in HRU during simulation (kg N/ha)
  hruaao(48,:) amount of nitrogen lost by denitrification in HRU during simulation (kg N/ha)
  hruaao(49,:) amount of nitrogen moving from active organic to nitrate pool in HRU during simulation (kg N/ha)
  hruaao(50,:) amount of nitrogen moving from active organic to stable organic pool in HRU during simulation (kg N/ha)
  hruaao(51,:) amount of phosphorus moving from organic to labile mineral pool in HRU during simulation (kg P/ha)
  hruaao(52,:) amount of nitrogen moving from fresh organic to nitrate and active organic pools in HRU during simulation (kg N/ha)
  hruaao(53,:) amount of phosphorus moving from fresh organic to the labile mineral and organic pools in HRU during simulation (kg P/ha)
  hruaao(54,:) amount of nitrogen added to soil in rain during simulation (kg N/ha)
  hruaao(61,:) daily soil loss predicted with USLE equation (metric tons/ha)
  hruaao(63,:) less persistent bacteria transported to main channel from HRU during simulation (# bacteria/ha)
  hruaao(64,:) persistent bacteria transported to main channel from HRU during simulation (# bacteria/ha)
  hruaao(65,:) nitrate loading from groundwater in HRU to main channel during simulation (kg N/ha)
  hruaao(66,:) soluble P loading from groundwater in HRU to main channel during simulation (kg P/ha)
  hruaao(67,:) loading of mineral P attached to sediment in HRU to main channel during simulation (kg P/ha)

- real ∗8, dimension(:,:), allocatable parm::subaao

  subbasin average annual output array (varies)

- real ∗8, dimension(:,:), allocatable parm::resoutm

  reservoir monthly output array (varies)
  resoutm(1,:) flow into reservoir during month (m^ 3/s)
  resoutm(2,:) flow out of reservoir during month (m^ 3/s)
  resoutm(3,:) sediment entering reservoir during month (metric tons)
  resoutm(4,:) sediment leaving reservoir during month (metric tons)
  resoutm(5,:) sediment concentration in reservoir during month (mg/L)
  resoutm(6,:) pesticide entering reservoir during month (mg pst)
  resoutm(7,:) pesticide lost from reservoir through reactions during month (mg pst)
  resoutm(8,:) pesticide lost from reservoir through volatilization during month (mg pst)
  resoutm(9,:) pesticide moving from water to sediment through settling during month (mg pst)
  resoutm(10,:) pesticide moving from sediment to water through resuspension during month (mg pst)
  resoutm(11,:) pesticide moving from water to sediment through diffusion during month (mg pst)
  resoutm(12,:) pesticide lost from reservoir sediment layer through reactions during month (mg pst)
  resoutm(13,:) pesticide lost from reservoir sediment layer through burial during month (mg pst)
  resoutm(14,:) pesticide transported out of reservoir during month (mg pst)
  resoutm(15,:) pesticide concentration in reservoir water during month (mg pst/m^ 3)
  resoutm(16,:) pesticide concentration in reservoir sediment layer during month (mg pst/m^ 3)
  resoutm(17,:) evaporation from reservoir during month (m^ 3 H2O)
  resoutm(18,:) seepage from reservoir during month (m^ 3 H2O)
  resoutm(19,:) precipitation on reservoir during month (m^ 3 H2O)
  resoutm(22,:) organic N entering reservoir during month (kg N)
  resoutm(23,:) organic N leaving reservoir during month (kg N)
  resoutm(24,:) organic P entering reservoir during month (kg P)
  resoutm(25,:) organic P leaving reservoir during month (kg P)
  resoutm(26,:) nitrate entering reservoir during month (kg N)
  resoutm(27,:) nitrate leaving reservoir during month (kg N)
  resoutm(28,:) nitrite entering reservoir during month (kg N)
  resoutm(29,:) nitrite leaving reservoir during month (kg N)
  resoutm(30,:) ammonia entering reservoir during month (kg N)
  resoutm(31,:) ammonia leaving reservoir during month (kg N)
  resoutm(32,:) mineral P entering reservoir during month (kg P)
  resoutm(33,:) mineral P leaving reservoir during month (kg P)
  resoutm(34,:) chlorophyll-a entering reservoir during month (kg chla)
  resoutm(35,:) chlorophyll-a leaving reservoir during month (kg chla)
  resoutm(36,:) organic P concentration in reservoir water during month (mg P/L)
  resoutm(37,:) mineral P concentration in reservoir water during month (mg P/L)
  resoutm(38,:) organic N concentration in reservoir water during month (mg N/L)
  resoutm(39,:) nitrate concentration in reservoir water during month (mg N/L)
  resoutm(40,:) nitrite concentration in reservoir water during month (mg N/L)
  resoutm(41,:) ammonia concentration in reservoir water during month (mg N/L)

- real ∗8, dimension(:,:), allocatable parm::resouty

  reservoir annual output array (varies)
  resouty(1,:) flow into reservoir during year (m^ 3/s)
  resouty(2,:) flow out of reservoir during year (m^ 3/s)
  resouty(3,:) sediment entering reservoir during year (metric tons)
  resouty(4,:) sediment leaving reservoir during year (metric tons)
  resouty(5,:) sediment concentration in reservoir during year (mg/L)
  resouty(6,:) pesticide entering reservoir during year (mg pst)
  resouty(7,:) pesticide lost from reservoir through reactions during year (mg pst)
  resouty(8,:) pesticide lost from reservoir through volatilization during year (mg pst)
  resouty(9,:) pesticide moving from water to sediment through settling during year (mg pst)
  resouty(10,:) pesticide moving from sediment to water through resuspension during year (mg pst)
  resouty(11,:) pesticide moving from water to sediment through diffusion during year (mg pst)
  resouty(12,:) pesticide lost from reservoir sediment layer through reactions during year (mg pst)
  resouty(13,:) pesticide lost from reservoir sediment layer through burial during year (mg pst)
  resouty(14,:) pesticide transported out of reservoir during year (mg pst)
  resouty(15,:) pesticide concentration in reservoir water during year (mg pst/m^ 3)
  resouty(16,:) pesticide concentration in reservoir sediment layer during year (mg pst/m^ 3)
  resouty(17,:) evaporation from reservoir during year (m^ 3 H2O)
  resouty(18,:) seepage from reservoir during year (m^ 3 H2O)
  resouty(19,:) precipitation on reservoir during year (m^ 3 H2O)
  resouty(22,:) organic N entering reservoir during year (kg N)

resouty(23,:) organic N leaving reservoir during year (kg N)
resouty(24,:) organic P entering reservoir during year (kg P)
resouty(25,:) organic P leaving reservoir during year (kg P)
resouty(26,:) nitrate entering reservoir during year (kg N)
resouty(27,:) nitrate leaving reservoir during year (kg N)
resouty(28,:) nitrite entering reservoir during year (kg N)
resouty(29,:) nitrite leaving reservoir during year (kg N)
resouty(30,:) ammonia entering reservoir during year (kg N)
resouty(31,:) ammonia leaving reservoir during year (kg N)
resouty(32,:) mineral P entering reservoir during year (kg P)
resouty(33,:) mineral P leaving reservoir during year (kg P)
resouty(34,:) chlorophyll-a entering reservoir during year (kg chla)
resouty(35,:) chlorophyll-a leaving reservoir during year (kg chla)
resouty(36,:) organic P concentration in reservoir water during year (mg P/L)
resouty(37,:) mineral P concentration in reservoir water during year (mg P/L)
resouty(38,:) organic N concentration in reservoir water during year (mg N/L)
resouty(39,:) nitrate concentration in reservoir water during year (mg N/L)
resouty(40,:) nitrite concentration in reservoir water during year (mg N/L)
resouty(41,:) ammonia concentration in reservoir water during year (mg N/L)

- real ∗8, dimension(:,:), allocatable parm::resouta

  reservoir average annual output array (varies)
  resouta(3,:) sediment entering reservoir during simulation (metric tons)
  resouta(4,:) sediment leaving reservoir during simulation (metric tons)
  resouta(17,:) evaporation from reservoir during simulation (m^3 H2O)
  resouta(18,:) seepage from reservoir during simulation (m^3 H2O)
  resouta(19,:) precipitation on reservoir during simulation (m^3 H2O)
  resouta(20,:) water entering reservoir during simulation (m^3 H2O)
  resouta(21,:) water leaving reservoir during simulation (m^3 H2O)

- real ∗8, dimension(12, 8) parm::wshd_aamon

  wshd_aamon(:,1) average annual precipitation in watershed falling during month (mm H2O)
  wshd_aamon(:,2) average annual freezing rain in watershed falling during month (mm H2O)
  wshd_aamon(:,3) average annual surface runoff in watershed during month (mm H2O)
  wshd_aamon(:,4) average annual lateral flow in watershed during month (mm H2O)
  wshd_aamon(:,5) average annual water yield in watershed during month (mm H2O)
  wshd_aamon(:,6) average annual actual evapotranspiration in watershed during month (mm H2O)
  wshd_aamon(:,7) average annual sediment yield in watershed during month (metric tons)
  wshd_aamon(:,8) average annual potential evapotranspiration in watershed during month (mm H2O)

- real ∗8, dimension(:,:), allocatable parm::wtrmon

  HRU monthly output data array for impoundments (varies)
  wtrmon(1,:) evaporation from ponds in HRU for month (mm H2O)
  wtrmon(2,:) seepage from ponds in HRU for month (mm H2O)
  wtrmon(3,:) precipitation on ponds in HRU for month (mm H2O)
  wtrmon(4,:) amount of water entering ponds in HRU for month (mm H2O)
  wtrmon(5,:) sediment entering ponds in HRU for month (metric tons/ha)
  wtrmon(6,:) amount of water leaving ponds in HRU for month (mm H2O)
  wtrmon(7,:) sediment leaving ponds in HRU for month (metric tons/ha)
  wtrmon(8,:) precipitation on wetlands in HRU for month (mm H2O)
  wtrmon(9,:) volume of water entering wetlands from HRU for month (mm H2O)
  wtrmon(10,:) sediment loading to wetlands for month from HRU (metric tons/ha)
  wtrmon(11,:) evaporation from wetlands in HRU for month (mm H2O)
  wtrmon(12,:) seeepage from wetlands in HRU for month (mm H2O)
  wtrmon(13,:) volume of water leaving wetlands in HRU for month (mm H2O)
  wtrmon(14,:) sediment loading from wetlands in HRU to main channel during month (metric tons/ha)
  wtrmon(15,:) precipitation on potholes in HRU for month (mm H2O)
  wtrmon(16,:) evaporation from potholes in HRU for month (mm H2O)
  wtrmon(17,:) seepage from potholes in HRU for month (mm H2O)
  wtrmon(18,:) water leaving potholes in HRU for month (mm H2O)
  wtrmon(19,:) water entering potholes in HRU for month (mm H2O)
  wtrmon(20,:) sediment entering potholes in HRU for month (metric tons/ha)
  wtrmon(21,:) sediment leaving potholes in HRU for month (metric tons/ha)

- real ∗8, dimension(:,:), allocatable parm::wtryr

HRU impoundment annual output array (varies)
wtryr(1,:) evaporation from ponds in HRU for year (mm H20)
wtryr(2,:) seepage from ponds in HRU for year (mm H20)
wtryr(3,:) precipitation on ponds in HRU for year (mm H20)
wtryr(4,:) amount of water entering ponds in HRU for year (mm H20)
wtryr(5,:) sediment entering ponds in HRU for year (metric tons/ha)
wtryr(6,:) amount of water leaving ponds in HRU for year (mm H20)
wtryr(7,:) sediment leaving ponds in HRU for year (metric tons/ha)
wtryr(8,:) precipitation on wetlands in HRU for year (mm H20)
wtryr(9,:) volume of water entering wetlands from HRU for year (mm H20)
wtryr(10,:) sediment loading to wetlands for year from HRU (metric tons/ha)
wtryr(11,:) evaporation from wetlands in HRU for year (mm H20)
wtryr(12,:) seeepage from wetlands in HRU for year (mm H20)
wtryr(13,:) volume of water leaving wetlands in HRU for year (mm H20)
wtryr(14,:) sediment loading from wetlands in HRU to main channel during year (metric tons/ha)
wtryr(15,:) precipitation on potholes in HRU during year (mm H20)
wtryr(16,:) evaporation from potholes in HRU during year (mm H20)
wtryr(17,:) seepage from potholes in HRU during year (mm H20)
wtryr(18,:) water leaving potholes in HRU during year (mm H20)
wtryr(19,:) water entering potholes in HRU during year (mm H20)
wtryr(20,:) sediment entering potholes in HRU during year (metric tons/ha)
wtryr(21,:) sediment leaving potholes in HRU during year (metric tons/ha)

- real ∗8, dimension(:,:), allocatable parm::wtraa

  HRU impoundment average annual output array (varies)

- real ∗8, dimension(:,:), allocatable parm::sub_smfmx

  max melt rate for snow during year (June 21) for subbasin(:) where deg C refers to the air temperature. SUB_SMFMX and SMFMN allow the rate of snow melt to vary through the year. These parameters are accounting for the impact of soil temperature on snow melt (range: -5.0/5.0) (mm/deg C/day)

- real ∗8, dimension(:,:), allocatable parm::sub_smfmn

  min melt rate for snow during year (Dec 21) for subbasin(:) (range: -5.0/5.0) where deg C refers to the air temperature (mm/deg C/day)

- real ∗8, dimension(:,:,:), allocatable parm::hrupstd

  hrupstd(1,:,:) amount of pesticide type in surface runoff contribution to stream from HRU on day (in solution) (mg pst)
  hrupstd(2,:,:) amount of pesticide type in surface runoff contribution to stream from HRU on day (sorbed to sediment) (mg pst)
  hrupstd(3,:,:) total pesticide loading to stream in surface runoff from HRU (mg pst/ha)
  hrupstd(4,:,:) amount of pesticide type in lateral flow contribution to stream from HRU on day (in solution) (mg pst)

- real ∗8, dimension(:,:,:), allocatable parm::hrupstm

  hrupstm(:,:,:)HRU monthly pesticide output array (varies)
  hrupstm(1,:,:) amount of pesticide type in surface runoff contribution to stream from HRU during month (in solution) (mg pst)
  hrupstm(2,:,:) amount of pesticide type in surface runoff contribution to stream from HRU during month (sorbed to sediment) (mg pst)
  hrupstm(3,:,:) total pesticide loading to stream in surface runoff from HRU during month (mg pst)

- real ∗8, dimension(:,:,:), allocatable parm::hrupsta

  HRU average annual pesticide output array (varies)

- real ∗8, dimension(:,:,:), allocatable parm::hrupsty

  hrupsty(:,:,:) HRU annual pesticide output array (varies)
  hrupsty(1,:,:) amount of pesticide type in surface runoff contribution to stream from HRU during year (in solution) (mg pst)
  hrupsty(2,:,:) amount of pesticide type in surface runoff contribution to stream from HRU during year (sorbed to sediment) (mg pst)

- integer, dimension(:), allocatable parm::ifirstt

  temperature data search code (none)
  0 first day of temperature data located in file
  1 first day of temperature data not located in file

- integer, dimension(:), allocatable **parm::ifirstpcp**
- integer, dimension(:), allocatable parm::elevp

  elevation of precipitation gage station (m)

- integer, dimension(:), allocatable parm::elevt

  elevation of temperature gage station (m)
- real ∗8, dimension(:,:), allocatable parm::ftmpmn

  avg monthly minimum air temperature (deg C)
- real ∗8, dimension(:,:), allocatable parm::ftmpmx

  avg monthly maximum air temperature (deg C)
- real ∗8, dimension(:,:), allocatable parm::ftmpstdmn

  standard deviation for avg monthly minimum air temperature (deg C)
- real ∗8, dimension(:,:), allocatable parm::ftmpstdmx

  standard deviation for avg monthly maximum air temperature (deg C)
- real ∗8, dimension(:,:,:), allocatable parm::fpcp_stat

  fpcp_stat(:,1,:): average amount of precipitation falling in one day for the month (mm/day)
  fpcp_stat(:,2,:): standard deviation for the average daily precipitation (mm/day)
  fpcp_stat(:,3,:): skew coefficient for the average daily precipitationa (none)
- real ∗8, dimension(:,:), allocatable parm::fpr_w1

  probability of wet day after dry day in month (none)
- real ∗8, dimension(:,:), allocatable parm::fpr_w2

  probability of wet day after wet day in month (none)
- real ∗8, dimension(:,:), allocatable parm::fpr_w3

  proportion of wet days in the month (none)
- real ∗8, dimension(:), allocatable parm::ch_d

  average depth of main channel (m)
- real ∗8, dimension(:), allocatable parm::flwin

  flow into reach on current day (m^3 H2O)
- real ∗8, dimension(:), allocatable parm::flwout

  flow out of reach on current day (m^3 H2O)
- real ∗8, dimension(:), allocatable parm::bankst

  bank storage (m^3 H2O)
- real ∗8, dimension(:), allocatable **parm::ch_wi**
- real ∗8, dimension(:), allocatable parm::ch_onco

  channel organic n concentration (ppm)
- real ∗8, dimension(:), allocatable parm::ch_opco

  channel organic p concentration (ppm)
- real ∗8, dimension(:), allocatable **parm::ch_orgn**
- real ∗8, dimension(:), allocatable **parm::ch_orgp**
- real ∗8, dimension(:), allocatable parm::drift

  amount of pesticide drifting onto main channel in subbasin (kg)
- real ∗8, dimension(:), allocatable parm::rch_dox

  dissolved oxygen concentration in reach (mg O2/L)
- real ∗8, dimension(:), allocatable parm::rch_bactp

  persistent bacteria in reach/outflow at end of day (# cfu/100ml)
- real ∗8, dimension(:), allocatable parm::alpha_bnk

  alpha factor for bank storage recession curve (days)
- real ∗8, dimension(:), allocatable parm::alpha_bnke

  $\exp(-alpha_bnk)$ *(none)*
- real ∗8, dimension(:), allocatable parm::rchstor

  water stored in reach (m^3 H2O)
- real ∗8, dimension(:), allocatable parm::sedst

  amount of sediment stored in reach (metric tons)
- real ∗8, dimension(:), allocatable parm::algae

  algal biomass concentration in reach (mg alg/L)

- real ∗8, dimension(:), allocatable parm::disolvp

  dissolved phosphorus concentration in reach (mg P/L)
- real ∗8, dimension(:), allocatable parm::chlora

  chlorophyll-a concentration in reach (mg chl-a/L)
- real ∗8, dimension(:), allocatable parm::organicn

  organic nitrogen concentration in reach (mg N/L)
- real ∗8, dimension(:), allocatable parm::organicp

  organic phosphorus concentration in reach (mg P/L)
- real ∗8, dimension(:), allocatable parm::ch_li

  initial length of main channel (km)
- real ∗8, dimension(:), allocatable parm::ch_si

  initial slope of main channel (m/m)
- real ∗8, dimension(:), allocatable parm::nitraten

  nitrate concentration in reach (mg N/L)
- real ∗8, dimension(:), allocatable parm::nitriten

  nitrite concentration in reach (mg N/L)
- real ∗8, dimension(:), allocatable **parm::ch_bnk_san**
- real ∗8, dimension(:), allocatable **parm::ch_bnk_sil**
- real ∗8, dimension(:), allocatable **parm::ch_bnk_cla**
- real ∗8, dimension(:), allocatable **parm::ch_bnk_gra**
- real ∗8, dimension(:), allocatable **parm::ch_bed_san**
- real ∗8, dimension(:), allocatable **parm::ch_bed_sil**
- real ∗8, dimension(:), allocatable **parm::ch_bed_cla**
- real ∗8, dimension(:), allocatable **parm::ch_bed_gra**
- real ∗8, dimension(:), allocatable **parm::depfp**
- real ∗8, dimension(:), allocatable **parm::depsanfp**
- real ∗8, dimension(:), allocatable **parm::depsilfp**
- real ∗8, dimension(:), allocatable **parm::depclafp**
- real ∗8, dimension(:), allocatable **parm::depsagfp**
- real ∗8, dimension(:), allocatable **parm::deplagfp**
- real ∗8, dimension(:), allocatable **parm::depch**
- real ∗8, dimension(:), allocatable **parm::depsanch**
- real ∗8, dimension(:), allocatable **parm::depsilch**
- real ∗8, dimension(:), allocatable **parm::depclach**
- real ∗8, dimension(:), allocatable **parm::depsagch**
- real ∗8, dimension(:), allocatable **parm::deplagch**
- real ∗8, dimension(:), allocatable **parm::depgrach**
- real ∗8, dimension(:), allocatable **parm::depgrafp**
- real ∗8, dimension(:), allocatable **parm::grast**
- real ∗8, dimension(:), allocatable parm::r2adj

  curve number retention parameter adjustment factor to adjust surface runoff for flat slopes (0.5 - 3.0) (dimensionless)
- real ∗8, dimension(:), allocatable parm::prf

  Reach peak rate adjustment factor for sediment routing in the channel. Allows impact of peak flow rate on sediment routing and channel reshaping to be taken into account (none)
- real ∗8, dimension(:), allocatable **parm::depprch**
- real ∗8, dimension(:), allocatable **parm::depprfp**
- real ∗8, dimension(:), allocatable parm::spcon

  linear parameter for calculating sediment reentrained in channel sediment routing
- real ∗8, dimension(:), allocatable parm::spexp

  exponent parameter for calculating sediment reentrained in channel sediment routing
- real ∗8, dimension(:), allocatable **parm::sanst**
- real ∗8, dimension(:), allocatable **parm::silst**
- real ∗8, dimension(:), allocatable **parm::clast**

- real ∗8, dimension(:), allocatable **parm::sagst**
- real ∗8, dimension(:), allocatable **parm::lagst**
- real ∗8, dimension(:), allocatable **parm::pot_san**
- real ∗8, dimension(:), allocatable **parm::pot_sil**
- real ∗8, dimension(:), allocatable **parm::pot_cla**
- real ∗8, dimension(:), allocatable **parm::pot_sag**
- real ∗8, dimension(:), allocatable **parm::pot_lag**
- real ∗8, dimension(:), allocatable **parm::potsani**
- real ∗8, dimension(:), allocatable **parm::potsili**
- real ∗8, dimension(:), allocatable **parm::potclai**
- real ∗8, dimension(:), allocatable **parm::potsagi**
- real ∗8, dimension(:), allocatable **parm::potlagi**
- real ∗8, dimension(:), allocatable **parm::sanyld**
- real ∗8, dimension(:), allocatable **parm::silyld**
- real ∗8, dimension(:), allocatable **parm::clayld**
- real ∗8, dimension(:), allocatable **parm::sagyld**
- real ∗8, dimension(:), allocatable **parm::lagyld**
- real ∗8, dimension(:), allocatable **parm::grayld**
- real ∗8, dimension(:), allocatable **parm::res_san**
- real ∗8, dimension(:), allocatable **parm::res_sil**
- real ∗8, dimension(:), allocatable **parm::res_cla**
- real ∗8, dimension(:), allocatable **parm::res_sag**
- real ∗8, dimension(:), allocatable **parm::res_lag**
- real ∗8, dimension(:), allocatable **parm::res_gra**
- real ∗8, dimension(:), allocatable **parm::pnd_san**
- real ∗8, dimension(:), allocatable **parm::pnd_sil**
- real ∗8, dimension(:), allocatable **parm::pnd_cla**
- real ∗8, dimension(:), allocatable **parm::pnd_sag**
- real ∗8, dimension(:), allocatable **parm::pnd_lag**
- real ∗8, dimension(:), allocatable **parm::wet_san**
- real ∗8, dimension(:), allocatable **parm::wet_sil**
- real ∗8, dimension(:), allocatable **parm::wet_cla**
- real ∗8, dimension(:), allocatable **parm::wet_lag**
- real ∗8, dimension(:), allocatable **parm::wet_sag**
- real ∗8 **parm::ressano**
- real ∗8 **parm::ressilo**
- real ∗8 **parm::resclao**
- real ∗8 **parm::ressago**
- real ∗8 **parm::reslago**
- real ∗8 **parm::resgrao**
- real ∗8 **parm::ressani**
- real ∗8 **parm::ressili**
- real ∗8 **parm::resclai**
- real ∗8 **parm::ressagi**
- real ∗8 **parm::reslagi**
- real ∗8 **parm::resgrai**
- real ∗8 **parm::potsano**
- real ∗8 **parm::potsilo**
- real ∗8 **parm::potclao**
- real ∗8 **parm::potsago**
- real ∗8 **parm::potlago**
- real ∗8 **parm::pndsanin**
- real ∗8 **parm::pndsilin**
- real ∗8 **parm::pndclain**
- real ∗8 **parm::pndsagin**

- real ∗8 **parm::pndlagin**
- real ∗8 **parm::pndsano**
- real ∗8 **parm::pndsilo**
- real ∗8 **parm::pndclao**
- real ∗8 **parm::pndsago**
- real ∗8 **parm::pndlago**
- real ∗8, dimension(:), allocatable parm::ch_di

  initial depth of main channel (m)
- real ∗8, dimension(:), allocatable parm::ch_erod

  channel erodibility factor (0.0-1.0) (none)
  0 non-erosive channel
  1 no resistance to erosion
- real ∗8, dimension(:,:), allocatable parm::ch_l

  ch_l(1,:) longest tributary channel length in subbasin (km)
  ch_l(2,:) length of main channel (km)
- real ∗8, dimension(:), allocatable **parm::ch_cov**
- real ∗8, dimension(:), allocatable parm::ch_bnk_bd

  bulk density of channel bank sediment (1.1-1.9) (g/cc)
- real ∗8, dimension(:), allocatable parm::ch_bed_bd

  bulk density of channel bed sediment (1.1-1.9) (g/cc)
- real ∗8, dimension(:), allocatable parm::ch_bnk_kd

  erodibility of channel bank sediment by jet test (Peter Allen needs to give more info on this)
- real ∗8, dimension(:), allocatable parm::ch_bed_kd

  erodibility of channel bed sediment by jet test (Peter Allen needs to give more info on this)
- real ∗8, dimension(:), allocatable parm::ch_bnk_d50

  D50(median) particle size diameter of channel bank sediment (0.001 - 20)
- real ∗8, dimension(:), allocatable parm::ch_bed_d50

  D50(median) particle size diameter of channel bed sediment (micrometers) (0.001 - 20)
- real ∗8, dimension(:), allocatable parm::ch_cov1

  channel erodibility factor (0.0-1.0) (none)
  0 non-erosive channel
  1 no resistance to erosion
- real ∗8, dimension(:), allocatable parm::ch_cov2

  channel cover factor (0.0-1.0) (none)
  0 channel is completely protected from erosion by cover
  1 no vegetative cover on channel
- real ∗8, dimension(:), allocatable parm::tc_bed

  critical shear stress of channel bed (N/m2)
- real ∗8, dimension(:), allocatable parm::tc_bnk

  critical shear stress of channel bank (N/m2)
- integer, dimension(:), allocatable parm::ch_eqn

  sediment routine methods (DAILY):
  0 = original SWAT method
  1 = Bagnold's
  2 = Kodatie
  3 = Molinas WU
  4 = Yang
- real ∗8, dimension(:), allocatable parm::chpst_rea

  pesticide reaction coefficient in reach (1/day)
- real ∗8, dimension(:), allocatable parm::chpst_vol

  pesticide volatilization coefficient in reach (m/day)
- real ∗8, dimension(:), allocatable parm::chpst_conc

  initial pesticide concentration in reach (mg/(m^3))
- real ∗8, dimension(:), allocatable parm::chpst_koc

pesticide partition coefficient between water and sediment in reach (m^3/g)

- real ∗8, dimension(:), allocatable parm::chpst_rsp

    resuspension velocity in reach for pesticide sorbed to sediment (m/day)

- real ∗8, dimension(:), allocatable parm::chpst_stl

    settling velocity in reach for pesticide sorbed to sediment (m/day)

- real ∗8, dimension(:), allocatable parm::ch_wdr

    channel width to depth ratio (m/m)

- real ∗8, dimension(:), allocatable parm::chpst_mix

    mixing velocity (diffusion/dispersion) for pesticide in reach (m/day)

- real ∗8, dimension(:), allocatable parm::sedpst_conc

    inital pesticide concentration in river bed sediment (mg/m^3)

- real ∗8, dimension(:), allocatable parm::sedpst_bry

    pesticide burial velocity in river bed sediment (m/day)

- real ∗8, dimension(:), allocatable parm::sedpst_rea

    pesticide reaction coefficient in river bed sediment (1/day)

- real ∗8, dimension(:), allocatable parm::sedpst_act

    depth of active sediment layer in reach for pesticide (m)

- real ∗8, dimension(:), allocatable parm::rch_cbod

    carbonaceous biochemical oxygen demand in reach (mg O2/L)

- real ∗8, dimension(:), allocatable parm::rch_bactlp

    less persistent bacteria in reach/outflow at end of day (# cfu/100ml)

- real ∗8, dimension(:), allocatable parm::chside

    change in horizontal distance per unit vertical distance (0.0 - 5)
    0 = for vertical channel bank
    5 = for channel bank with gentl side slope

- real ∗8, dimension(:), allocatable parm::rs1

    local algal settling rate in reach at 20 deg C (m/day or m/hour)

- real ∗8, dimension(:), allocatable parm::rs2

    benthos source rate for dissolved phosphorus in reach at 20 deg C ((mg disP-P)/(m^2∗day) or (mg dis←- P-P)/(m^2∗hour))

- real ∗8, dimension(:), allocatable parm::rs3

    benthos source rate for ammonia nitrogen in reach at 20 deg C ((mg NH4-N)/(m^2∗day) or (mg NH4-N)/(m^2∗hour))

- real ∗8, dimension(:), allocatable parm::rs4

    rate coefficient for organic nitrogen settling in reach at 20 deg C (1/day or 1/hour)

- real ∗8, dimension(:), allocatable parm::rs5

    organic phosphorus settling rate in reach at 20 deg C (1/day or 1/hour)

- real ∗8, dimension(:), allocatable parm::rk1

    CBOD deoxygenation rate coefficient in reach at 20 deg C (1/day or 1/hour)

- real ∗8, dimension(:), allocatable parm::rk2

    reaeration rate in accordance with Fickian diffusion in reach at 20 deg C (1/day or 1/hour)

- real ∗8, dimension(:), allocatable parm::rk3

    rate of loss of CBOD due to settling in reach at 20 deg C (1/day or 1/hour)

- real ∗8, dimension(:), allocatable parm::rk4

    sediment oxygen demand rate in reach at 20 deg C (mg O2/(m^2∗day) or mg O2/(m^2∗hour))

- real ∗8, dimension(:), allocatable parm::rk5

    coliform die-off rate in reach (1/day)

- real ∗8, dimension(:), allocatable parm::rs6

    rate coefficient for settling of arbitrary non-conservative constituent in reach (1/day)

- real ∗8, dimension(:), allocatable parm::rs7

    benthal source rate for arbitrary non-conservative constituent in reach ((mg ANC)/(m^2∗day))

- real ∗8, dimension(:), allocatable parm::bc1 *rate constant for biological oxidation of NH3 to NO2 in reach at 20 deg C (1/day or 1/hour)*

- real ∗8, dimension(:), allocatable parm::bc2

  rate constant for biological oxidation of NO2 to NO3 in reach at 20 deg C (1/day or 1/hour)
- real ∗8, dimension(:), allocatable parm::bc3

  rate constant for hydrolysis of organic N to ammonia in reach at 20 deg C (1/day or 1/hour)
- real ∗8, dimension(:), allocatable parm::bc4

  rate constant for the decay of organic P to dissolved P in reach at 20 deg C (1/day or 1/hour)
- real ∗8, dimension(:), allocatable parm::rk6

  decay rate for arbitrary non-conservative constituent in reach (1/day)
- real ∗8, dimension(:), allocatable parm::ammonian

  ammonia concentration in reach (mg N/L)
- real ∗8, dimension(:), allocatable **parm::orig_sedpstconc**
- real ∗8, dimension(:,:), allocatable parm::wurch

  average daily water removal from the reach for the month (10^4 m^3/day)
- integer, dimension(:), allocatable **parm::icanal**
- integer, dimension(:), allocatable **parm::itb**
- real ∗8, dimension(:), allocatable parm::ch_revap

  revap coeff: this variable controls the amount of water moving from bank storage to the root zone as a result of soil moisture depletion (none)
- real ∗8, dimension(:), allocatable **parm::dep_chan**
- real ∗8, dimension(:), allocatable parm::harg_petco

  coefficient related to radiation used in hargreaves eq (range: 0.0019 - 0.0032)
- real ∗8, dimension(:), allocatable **parm::subfr_nowtr**
- real ∗8, dimension(:), allocatable parm::cncoef_sub

  soil water depletion coefficient used in the new (modified curve number method) same as soil index coeff used in APEX range: 0.5 - 2.0
- real ∗8, dimension(:), allocatable **parm::dr_sub**
- real ∗8, dimension(:), allocatable parm::sub_fr

  fraction of total watershed area contained in subbasin (km2/km2)
- real ∗8, dimension(:), allocatable parm::sub_sw

  amount of water in soil profile in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable parm::sub_minp

  amount of phosphorus stored in all mineral pools sorbed to sediment (kg P/ha)
- real ∗8, dimension(:), allocatable **parm::wcklsp**
- real ∗8, dimension(:), allocatable parm::sub_gwno3

  nitrate loading in groundwater from subbasin (kg N/ha)
- real ∗8, dimension(:), allocatable parm::sub_sumfc

  amount of water in soil at field capacity in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable **parm::sub_gwsolp**
- real ∗8, dimension(:), allocatable parm::co2

  CO2 concentration (ppmv)
- real ∗8, dimension(:), allocatable parm::sub_km

  area of subbasin in square kilometers (km^2)
- real ∗8, dimension(:), allocatable parm::wlat

  latitude of weather station used to compile data (degrees)
- real ∗8, dimension(:), allocatable parm::sub_tc

  time of concentration for subbasin (hour)
- real ∗8, dimension(:), allocatable parm::sub_pet

  potential evapotranspiration for day in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable parm::welev

  elevation of weather station used to compile weather generator data (m)
- real ∗8, dimension(:), allocatable parm::sub_bd

average bulk density in subbasin for top 10 mm of first soil layer (Mg/m^3)

- real ∗8, dimension(:), allocatable parm::sub_orgn

  amount of nitrogen stored in all organic pools (kg N/ha)
- real ∗8, dimension(:), allocatable parm::sub_orgp

  amount of phosphorus stored in all organic pools (kg P/ha)
- real ∗8, dimension(:), allocatable parm::sub_sedpa

  amount of active mineral P attached to sediment removed in surface runoff on day in subbasin (kg P/ha)
- real ∗8, dimension(:), allocatable parm::sub_sedps

  amount of stable mineral P attached to sediment removed in surface runoff on day in subbasin (kg P/ha)
- real ∗8, dimension(:), allocatable **parm::sub_wtmp**
- real ∗8, dimension(:), allocatable parm::daylmn

  shortest daylength occurring during the year (hour)
- real ∗8, dimension(:), allocatable parm::sub_minpa

  amount of phosphorus stored in active mineral pools sorbed to sediment (kg P/ha)
- real ∗8, dimension(:), allocatable parm::sub_minps

  amount of phosphorus stored in stable mineral pools sorbed to sediment (kg P/ha)
- real ∗8, dimension(:), allocatable parm::latcos

  $\cos(latitude)$ *(none)*
- real ∗8, dimension(:), allocatable parm::latsin

  $\sin(latitude)$ *(none)*
- real ∗8, dimension(:), allocatable parm::phutot

  total potential heat units for year (used when no crop is growing) (heat unit)
- real ∗8, dimension(:), allocatable parm::plaps

  precipitation lapse rate: precipitation change due to change in elevation (mm H2O/km)
- real ∗8, dimension(:), allocatable parm::tlaps

  temperature lapse rate: temperature change due to change in elevation (deg C/km)
- real ∗8, dimension(:), allocatable parm::tmp_an

  average annual air temperature (deg C)
- real ∗8, dimension(:), allocatable parm::sub_precip

  effective precipitation (amount of water reaching soil surface) for the day in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable parm::rammo_sub

  atmospheric deposition of ammonium values for entire watershed (mg/l)
- real ∗8, dimension(:), allocatable parm::rcn_sub

  atmospheric deposition of nitrate for entire watershed (mg/l)
- real ∗8, dimension(:), allocatable **parm::pcpdays**
- real ∗8, dimension(:), allocatable **parm::atmo_day**
- real ∗8, dimension(:), allocatable parm::sub_snom

  amount of snow melt in subbasin on day (mm H2O)
- real ∗8, dimension(:), allocatable parm::sub_qd

  surface runoff that reaches main channel during day in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable parm::sub_sedy

  sediment yield for the day in subbasin (metric tons)
- real ∗8, dimension(:), allocatable parm::sub_tran

  transmission losses on day in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable parm::sub_no3

  NO3-N in surface runoff on day in subbasin (kg N/ha)
- real ∗8, dimension(:), allocatable parm::sub_latno3

  NO3-N in lateral flow on day in subbasin (kg N/ha)
- real ∗8, dimension(:,:), allocatable parm::sub_sftmp

  snowfall temperature for subbasin(:). Mean air temperature at which precip is equally likely to be rain as snow/freezing rain (range: -5.0/5.0) (deg C)

- real ∗8, dimension(:,:), allocatable parm::sub_smtmp

  snow melt base temperature for subbasin(:) mean air temperature at which snow melt will occur (range: -5.0/5.0) (deg C)
- real ∗8, dimension(:,:), allocatable parm::sub_timp

  snow pack temperature lag factor (0-1) (none)
  1 = no lag (snow pack temp=current day air temp) as the lag factor goes to zero, the snow pack's temperature will be less influenced by the current day's air temperature
- real ∗8, dimension(:), allocatable **parm::sub_tileno3**
- real ∗8, dimension(:), allocatable parm::sub_etday

  actual evapotranspiration on day in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable parm::sub_solp

  soluble P in surface runoff on day in subbasin (kg P/ha)
- real ∗8, dimension(:), allocatable parm::sub_subp

  precipitation for day in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable parm::sub_elev

  average elevation of HRU (m)
- real ∗8, dimension(:), allocatable parm::sub_surfq

  surface runoff generated on day in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable parm::sub_wyld

  water yield on day in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable **parm::qird**
- real ∗8, dimension(:), allocatable parm::sub_gwq

  groundwater flow on day in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable parm::sub_sep

  seepage from bottom of soil profile on day in subbasin (mm H2O)
- real ∗8, dimension(:), allocatable parm::sub_chl

  chlorophyll-a in water yield on day in subbasin (kg chl-a)
- real ∗8, dimension(:), allocatable parm::sub_cbod

  carbonaceous biological oxygen demand on day for subbasin (kg O2)
- real ∗8, dimension(:), allocatable parm::sub_dox

  dissolved oxygen loading on day for subbasin (kg O2)
- real ∗8, dimension(:), allocatable parm::sub_solpst

  pesticide in solution in surface runoff on day in subbasin (mg pst)
- real ∗8, dimension(:), allocatable parm::sub_yorgn

  organic N in surface runoff on day in subbasin (kg P/ha)
- real ∗8, dimension(:), allocatable parm::sub_yorgp

  organic P in surface runoff on day in subbasin (kg P/ha)
- real ∗8, dimension(:), allocatable parm::sub_sorpst

  pesticide sorbed to sediment in surface runoff on day in subbasin (mg pst)
- real ∗8, dimension(:), allocatable parm::sub_lat

  latitude of HRU/subbasin (degrees)
- real ∗8, dimension(:), allocatable parm::sub_bactlp

  less persistent bacteria in surface runoff for day in subbasin (# cfu/m^2)
- real ∗8, dimension(:), allocatable parm::sub_bactp

  persistent bacteria in surface runoff for day in subbasin (# cfu/m^2)
- real ∗8, dimension(:), allocatable **parm::sub_latq**
- real ∗8, dimension(:), allocatable **parm::sub_gwq_d**
- real ∗8, dimension(:), allocatable **parm::sub_tileq**
- real ∗8, dimension(:), allocatable **parm::sub_vaptile**
- real ∗8, dimension(:), allocatable **parm::sub_dsan**
- real ∗8, dimension(:), allocatable **parm::sub_dsil**
- real ∗8, dimension(:), allocatable **parm::sub_dcla**

- real ∗8, dimension(:), allocatable **parm::sub_dsag**
- real ∗8, dimension(:), allocatable **parm::sub_dlag**
- real ∗8 **parm::vap_tile**
- real ∗8, dimension(:), allocatable **parm::wnan**
- real ∗8, dimension(:,:), allocatable **parm::sol_stpwt**
- real ∗8, dimension(:,:), allocatable parm::sub_pst

  amount of pesticide in soil layer in subbasin (kg/ha)
- real ∗8, dimension(:,:), allocatable parm::sub_hhwtmp

  water temperature for the time step in subbasin (deg C)
- real ∗8, dimension(:,:), allocatable **parm::sub_hhqd**
- real ∗8, dimension(:,:), allocatable parm::huminc

  monthly humidity adjustment. Daily values for relative humidity within the month are rasied or lowered by the specified amount (used in climate change studies) (none)
- real ∗8, dimension(:,:), allocatable parm::radinc

  monthly solar radiation adjustment. Daily radiation within the month is raised or lowered by the specified amount (used in climate change studies) (MJ/m^2)
- real ∗8, dimension(:,:), allocatable parm::rfinc

  monthly rainfall adjustment. Daily rainfall within the month is adjusted to the specified percentage of the original value (used in climate change studies)(%)
- real ∗8, dimension(:,:), allocatable parm::tmpinc

  monthly temperature adjustment. Daily maximum and minimum temperatures within the month are raised or lowered by the specified amount (used in climate change studies) (deg C)
- real ∗8, dimension(:,:), allocatable parm::ch_k

  ch_k(1,:) effective hydraulic conductivity of tributary channel alluvium (mm/hr)
  ch_k(2,:) effective hydraulic conductivity of main channel alluvium (mm/hr)
- real ∗8, dimension(:,:), allocatable parm::elevb

  elevation at the center of the band in subbasin (m)
- real ∗8, dimension(:,:), allocatable parm::elevb_fr

  fraction of subbasin area within elevation band (the same fractions should be listed for all HRUs within the subbasin) (none)
- real ∗8, dimension(:,:), allocatable parm::wndav

  average wind speed for the month (m/s)
- real ∗8, dimension(:,:), allocatable parm::ch_n

  ch_n(1,:) Manning's "n" value for the tributary channels (none)
  ch_n(2,:) Manning's "n" value for the main channel (none)
- real ∗8, dimension(:,:), allocatable parm::ch_s

  ch_s(1,:) average slope of tributary channels (m/m)
  ch_s(2,:) average slope of main channel (m/m)
- real ∗8, dimension(:,:), allocatable parm::ch_w

  ch_w(1,:) average width of tributary channels (m)
  ch_w(2,:) average width of main channel (m)
- real ∗8, dimension(:,:), allocatable parm::dewpt

  average dew point temperature for the month (deg C)
- real ∗8, dimension(:,:), allocatable parm::amp_r

  average fraction of total daily rainfall occuring in maximum half-hour period for month (none)
- real ∗8, dimension(:,:), allocatable parm::solarav

  average daily solar radiation for the month (MJ/m^2/day)
- real ∗8, dimension(:,:), allocatable parm::tmpstdmx

  standard deviation for avg monthly maximum air temperature (deg C)
- real ∗8, dimension(:,:), allocatable parm::pcf

  normalization coefficient for precipitation generated from skewed distribution (none)
- real ∗8, dimension(:,:), allocatable parm::tmpmn

  avg monthly minimum air temperature (deg C)

- real ∗8, dimension(:,:), allocatable parm::tmpmx

    avg monthly maximum air temperature (deg C)
- real ∗8, dimension(:,:), allocatable parm::tmpstdmn

    standard deviation for avg monthly minimum air temperature (deg C)
- real ∗8, dimension(:,:), allocatable **parm::otmpstdmn**
- real ∗8, dimension(:,:), allocatable **parm::otmpmn**
- real ∗8, dimension(:,:), allocatable **parm::otmpmx**
- real ∗8, dimension(:,:), allocatable **parm::otmpstdmx**
- real ∗8, dimension(:,:), allocatable **parm::ch_erodmo**
- real ∗8, dimension(:,:), allocatable **parm::uh**
- real ∗8, dimension(:,:), allocatable **parm::hqdsave**
- real ∗8, dimension(:,:), allocatable **parm::hsdsave**
- real ∗8, dimension(:,:), allocatable parm::pr_w1

    probability of wet day after dry day in month (none)
- real ∗8, dimension(:,:), allocatable parm::pr_w2

    probability of wet day after wet day in month (none)
- real ∗8, dimension(:,:), allocatable parm::pr_w3

    proportion of wet days in the month (none)
- real ∗8, dimension(:,:,:), allocatable **parm::pcp_stat**
- real ∗8, dimension(:,:), allocatable **parm::opr_w1**
- real ∗8, dimension(:,:), allocatable **parm::opr_w2**
- real ∗8, dimension(:,:), allocatable **parm::opr_w3**
- real ∗8, dimension(:,:,:), allocatable **parm::opcp_stat**
- integer, dimension(:), allocatable parm::ireg

    precipitation category (none):
    1 precipitation <= 508 mm/yr
    2 precipitation > 508 and <= 1016 mm/yr
    3 precipitation > 1016 mm/yr
- integer, dimension(:), allocatable parm::hrutot

    number of HRUs in subbasin (none)
- integer, dimension(:), allocatable **parm::hru1**
- integer, dimension(:), allocatable parm::ihgage

    HRU relative humidity data code (gage # for relative humidity data used in as HRU) (none)
- integer, dimension(:), allocatable parm::isgage

    HRU solar radiation data code (record # for solar radiation used in HRU) (none)
- integer, dimension(:), allocatable parm::iwgage

    HRU wind speed gage data code (gage # for wind speed data used in HRU) (none)
- integer, dimension(:), allocatable parm::subgis

    GIS code printed to output files (output.sub, .rch) (none)
- integer, dimension(:), allocatable parm::irgage

    subbasin rain gage data code (gage # for rainfall data used in HRU) (none)
- integer, dimension(:), allocatable parm::itgage

    subbasin temp gage data code (gage # for temperature data used in HRU) (none)
- integer, dimension(:), allocatable parm::irelh

    (none) irelh = 0 (dewpoint)
    irelh = 1 (relative humidity)
    note: inputs > 1.0 (dewpoint)
    inputs < 1.0 (relative hum)
- integer, dimension(:), allocatable **parm::fcst_reg**
- real ∗8, dimension(:,:), allocatable parm::sol_aorgn

    amount of nitrogen stored in the active organic (humic) nitrogen pool in soil layer (kg N/ha)
- real ∗8, dimension(:,:), allocatable parm::sol_fon

    amount of nitrogen stored in the fresh organic (residue) pool in soil layer (kg N/ha)

- real ∗8, dimension(:,:), allocatable parm::sol_tmp

  average temperature of soil layer on previous day or
  daily average temperature of soil layer (deg C)
- real ∗8, dimension(:,:), allocatable parm::sol_awc

  available water capacity of soil layer (mm H20/mm soil)
- real ∗8, dimension(:,:), allocatable parm::volcr

  crack volume for soil layer (mm)
- real ∗8, dimension(:,:), allocatable parm::sol_prk

  percolation storage from soil layer on current day (mm H2O)
- real ∗8, dimension(:,:), allocatable parm::pperco_sub

  subbasin phosphorus percolation coefficient. Ratio of soluble phosphorus in surface to soluble phosphorus in percolate
- real ∗8, dimension(:,:), allocatable parm::sol_stap

  amount of phosphorus in the soil layer stored in the stable mineral phosphorus pool (kg P/ha)
- real ∗8, dimension(:,:), allocatable parm::conv_wt

  factor which converts kg/kg soil to kg/ha (none)
- real ∗8, dimension(:,:), allocatable parm::sol_actp

  amount of phosphorus stored in the active mineral phosphorus pool (kg P/ha)
- real ∗8, dimension(:,:), allocatable parm::sol_solp

  soluble P concentration in top soil layer (mg P/kg soil) or
  amount of inorganic phosphorus stored in solution in soil layer. NOTE UNIT CHANGE! (kg P/ha)
- real ∗8, dimension(:,:), allocatable parm::crdep

  maximum or potential crack volume (mm)
- real ∗8, dimension(:,:), allocatable parm::sol_fc

  amount of water available to plants in soil layer at field capacity (fc - wp water) (mm H2O)
- real ∗8, dimension(:,:), allocatable parm::sol_ul

  amount of water held in the soil layer at saturation (sat - wp water) (mm H2O)
- real ∗8, dimension(:,:), allocatable parm::sol_bd

  bulk density of the soil layer in HRU (Mg/m^3)
- real ∗8, dimension(:,:), allocatable parm::sol_z

  depth to bottom of each soil profile layer in a given HRU (mm)
- real ∗8, dimension(:,:), allocatable parm::sol_st

  amount of water stored in the soil layer on any given day (less wilting point water) (mm H2O)
- real ∗8, dimension(:,:), allocatable parm::sol_up

  water content of soil at -0.033 MPa (field capacity) (mm H2O/mm soil)
- real ∗8, dimension(:,:), allocatable parm::sol_clay

  percent clay content in soil layer in HRU (UNIT CHANGE!) (% or none)
- real ∗8, dimension(:,:), allocatable parm::sol_hk

  beta coefficent to calculate hydraulic conductivity (none)
- real ∗8, dimension(:,:), allocatable parm::flat

  lateral flow storage in soil layer on current day (mm H2O)
- real ∗8, dimension(:,:), allocatable parm::sol_nh3

  amount of nitrogen stored in the ammonium pool in soil layer (kg N/ha)
- real ∗8, dimension(:,:), allocatable parm::sol_ec

  electrical conductivity of soil layer (dS/m)
- real ∗8, dimension(:,:), allocatable parm::sol_orgn

  amount of nitrogen stored in the stable organic N pool. NOTE UNIT CHANGE! (mg N/kg soil or kg N/ha)
- real ∗8, dimension(:,:), allocatable parm::sol_por

  total porosity of soil layer expressed as a fraction of the total volume (none)
- real ∗8, dimension(:,:), allocatable parm::sol_wp

  water content of soil at -1.5 MPa (wilting point) (mm H20/mm soil)

- real ∗8, dimension(:,:), allocatable parm::sol_orgp

  amount of phosphorus stored in the organic P pool in soil layer. NOTE UNIT CHANGE! (mg P/kg soil or kg P/ha)
- real ∗8, dimension(:,:), allocatable parm::sol_hum

  amount of organic matter in the soil layer classified as humic substances (kg humus/ha)
- real ∗8, dimension(:,:), allocatable parm::sol_wpmm

  water content of soil at -1.5 MPa (wilting point) (mm H20)
- real ∗8, dimension(:,:), allocatable parm::sol_no3

  amount of nitrogen stored in the nitrate pool in the soil layer. This variable is read in as a concentration and converted to kg/ha (this value is read from the .sol file in units of mg/kg) (kg N/ha)
- real ∗8, dimension(:,:), allocatable parm::sol_cbn

  percent organic carbon in soil layer (%)
- real ∗8, dimension(:,:), allocatable parm::sol_k

  saturated hydraulic conductivity of soil layer (mm/hour)
- real ∗8, dimension(:,:), allocatable parm::sol_rsd

  amount of organic matter in the soil layer classified as residue (kg/ha)
- real ∗8, dimension(:,:), allocatable parm::sol_fop

  amount of phosphorus stored in the fresh organic (residue) pool in soil layer (kg P/ha)
- real ∗8, dimension(:,:), allocatable parm::sol_rock

  percent of rock fragments in soil layer (%)
- real ∗8, dimension(:,:), allocatable parm::sol_silt

  percent silt content in soil material (UNIT CHANGE!) (% or none)
- real ∗8, dimension(:,:), allocatable parm::sol_sand

  percent sand content of soil material (%)
- real ∗8, dimension(:,:), allocatable **parm::orig_solno3**
- real ∗8, dimension(:,:), allocatable **parm::orig_solorgn**
- real ∗8, dimension(:,:), allocatable **parm::orig_solsolp**
- real ∗8, dimension(:,:), allocatable **parm::orig_solorgp**
- real ∗8, dimension(:,:), allocatable **parm::orig_soltmp**
- real ∗8, dimension(:,:), allocatable **parm::orig_solrsd**
- real ∗8, dimension(:,:), allocatable **parm::orig_solfop**
- real ∗8, dimension(:,:), allocatable **parm::orig_solfon**
- real ∗8, dimension(:,:), allocatable **parm::orig_solaorgn**
- real ∗8, dimension(:,:), allocatable **parm::orig_solst**
- real ∗8, dimension(:,:), allocatable **parm::orig_solactp**
- real ∗8, dimension(:,:), allocatable **parm::orig_solstap**
- real ∗8, dimension(:,:), allocatable **parm::orig_volcr**
- real ∗8, dimension(:,:), allocatable parm::conk

  lateral saturated hydraulic conductivity for each profile layer in a give HRU. For example (conk(2,1) is conductivity of layer from sol_z(1,1) to sol_z(2,1) in HRU1 (mm/hr)
- real ∗8, dimension(:,:,:), allocatable parm::sol_pst

  sol_pst(:,:,1) initial amount of pesticide in first layer read in from .chm file (mg/kg)
  sol_pst(:,:,:) amount of pesticide in soil layer. NOTE UNIT CHANGE! (kg/ha)
- real ∗8, dimension(:,:,:), allocatable parm::sol_kp

  pesticide sorption coefficient, Kp; the ratio of the concentration in the solid phase to the concentration in solution ((mg/kg)/(mg/L) or m^3/ton)
- real ∗8, dimension(:,:,:), allocatable **parm::orig_solpst**
- real ∗8, dimension(:), allocatable **parm::velsetlr**
- real ∗8, dimension(:), allocatable **parm::velsetlp**
- real ∗8, dimension(:), allocatable parm::br1

  1st shape parameter for reservoir surface area equation (none)
- real ∗8, dimension(:), allocatable parm::evrsv

  lake evaporation coefficient (none)
- real ∗8, dimension(:), allocatable parm::res_k

hydraulic conductivity of the reservoir bottom (mm/hr)

- real ∗8, dimension(:), allocatable parm::lkpst_conc

  pesticide concentration in lake water (mg/m^3)

- real ∗8, dimension(:), allocatable parm::res_evol

  volume of water needed to fill the reservoir to the emergency spillway (read in as 10^4 m^3 and converted to m^3) (m^3)

- real ∗8, dimension(:), allocatable parm::res_pvol

  volume of water needed to fill the reservoir to the principal spillway (read in as 10^4 m^3 and converted to m^3) (m^3)

- real ∗8, dimension(:), allocatable parm::res_vol

  reservoir volume (read in as 10^4 m^3 and converted to m^3) (m^3)

- real ∗8, dimension(:), allocatable parm::res_psa

  reservoir surface area when reservoir is filled to principal spillway (ha)

- real ∗8, dimension(:), allocatable parm::lkpst_rea

  pesticide reaction coefficient in lake water (1/day)

- real ∗8, dimension(:), allocatable parm::lkpst_vol

  pesticide volatilization coefficient in lake water (m/day)

- real ∗8, dimension(:), allocatable parm::br2

  2nd shape parameter for reservoir surface area equation (none)

- real ∗8, dimension(:), allocatable parm::res_rr

  average daily principal spillway release volume (read in as a release rate in m^3/s and converted to m^3/day) (m^3/day)

- real ∗8, dimension(:), allocatable parm::res_sed

  amount of sediment in reservoir (read in as mg/L and converted to kg/L) (kg/L)

- real ∗8, dimension(:), allocatable parm::lkpst_koc

  pesticide partition coefficient between water and sediment in lake water (m^3/g)

- real ∗8, dimension(:), allocatable parm::lkpst_mix

  mixing velocity (diffusion/dispersion) in lake water for pesticide (m/day)

- real ∗8, dimension(:), allocatable parm::lkpst_rsp

  resuspension velocity in lake water for pesticide sorbed to sediment (m/day)

- real ∗8, dimension(:), allocatable parm::lkpst_stl

  settling velocity in lake water for pesticide sorbed to sediment (m/day)

- real ∗8, dimension(:), allocatable parm::lkspst_conc

  pesticide concentration in lake bed sediment (mg/m^3)

- real ∗8, dimension(:), allocatable parm::lkspst_rea

  pesticide reaction coefficient in lake bed sediment (1/day)

- real ∗8, dimension(:), allocatable **parm::theta_n**
- real ∗8, dimension(:), allocatable **parm::theta_p**
- real ∗8, dimension(:), allocatable **parm::con_nirr**
- real ∗8, dimension(:), allocatable **parm::con_pirr**
- real ∗8, dimension(:), allocatable parm::lkspst_act

  depth of active sediment layer in lake for for pesticide (m)

- real ∗8, dimension(:), allocatable parm::lkspst_bry

  pesticide burial velocity in lake bed sediment (m/day)

- real ∗8, dimension(:), allocatable **parm::sed_stlr**
- real ∗8, dimension(7) **parm::resdata**
- real ∗8, dimension(:), allocatable parm::res_nsed

  normal amount of sediment in reservoir (read in as mg/L and convert to kg/L) (kg/L)

- real ∗8, dimension(:), allocatable parm::wurtnf

  fraction of water removed from the reservoir via WURESN which is returned and becomes flow from the reservoir outlet (none)

- real ∗8, dimension(:), allocatable parm::chlar

chlorophyll-a production coefficient for reservoir (none)
- real ∗8, dimension(:), allocatable parm::res_no3

  amount of nitrate in reservoir (kg N)
- real ∗8, dimension(:), allocatable parm::res_orgn

  amount of organic N in reservoir (kg N)
- real ∗8, dimension(:), allocatable parm::res_orgp

  amount of organic P in reservoir (kg P)
- real ∗8, dimension(:), allocatable parm::res_solp

  amount of soluble P in reservoir (kg P)
- real ∗8, dimension(:), allocatable parm::res_seci

  secchi-disk depth (m)
- real ∗8, dimension(:), allocatable **parm::res_chla**
- real ∗8, dimension(:), allocatable parm::res_esa

  reservoir surface area when reservoir is filled to emergency spillway (ha)
- real ∗8, dimension(:), allocatable parm::res_nh3

  amount of ammonia in reservoir (kg N)
- real ∗8, dimension(:), allocatable parm::res_no2

  amount of nitrite in reservoir (kg N)
- real ∗8, dimension(:), allocatable parm::seccir

  water clarity coefficient for reservoir (none)
- real ∗8, dimension(:), allocatable **parm::res_bactp**
- real ∗8, dimension(:), allocatable **parm::res_bactlp**
- real ∗8, dimension(:), allocatable parm::oflowmn_fps

  minimum reservoir outflow as a fraction of the principal spillway volume (0-1) (fraction)
- real ∗8, dimension(:), allocatable parm::starg_fps

  target volume as a fraction of the principal spillway volume (.1-5) (fraction)
- real ∗8, dimension(:), allocatable **parm::weirc**
- real ∗8, dimension(:), allocatable **parm::weirk**
- real ∗8, dimension(:), allocatable **parm::weirw**
- real ∗8, dimension(:), allocatable **parm::acoef**
- real ∗8, dimension(:), allocatable **parm::bcoef**
- real ∗8, dimension(:), allocatable **parm::ccoef**
- real ∗8, dimension(:), allocatable **parm::orig_resvol**
- real ∗8, dimension(:), allocatable **parm::orig_ressed**
- real ∗8, dimension(:), allocatable **parm::orig_lkpstconc**
- real ∗8, dimension(:), allocatable **parm::orig_lkspstconc**
- real ∗8, dimension(:), allocatable **parm::orig_ressolp**
- real ∗8, dimension(:), allocatable **parm::orig_resorgp**
- real ∗8, dimension(:), allocatable **parm::orig_resno3**
- real ∗8, dimension(:), allocatable **parm::orig_resno2**
- real ∗8, dimension(:), allocatable **parm::orig_resnh3**
- real ∗8, dimension(:), allocatable **parm::orig_resorgn**
- real ∗8, dimension(:,:), allocatable parm::oflowmn

  minimum daily ouflow for the month (read in as m^3/s and converted to m^3/day) (m^3/day)
- real ∗8, dimension(:,:), allocatable parm::oflowmx

  maximum daily ouflow for the month (read in as m^3/s and converted to m^3/day) (m^3/day)
- real ∗8, dimension(:,:), allocatable parm::starg

  monthly target reservoir storage (needed if IRESCO=2) (read in as 10^4 m^3 and converted to m^3) (m^3)
- real ∗8, dimension(:,:), allocatable parm::psetlr

  psetlr(1,:) phosphorus settling rate for mid-year period (read in as m/year and converted to m/day) (m/day)
  psetlr(2,:) phosphorus settling rate for remainder of year (read in as m/year and converted to m/day) (m/day)
- real ∗8, dimension(:,:), allocatable parm::nsetlr

nsetlr(1,:) nitrogen settling rate for mid-year period (read in as m/year and converted to m/day) (m/day)
nsetlr(2,:) nitrogen settling rate for remainder of year (read in as m/year and converted to m/day) (m/day)

- real ∗8, dimension(:,:), allocatable parm::wuresn

  average amount of water withdrawn from reservoir each month for consumptive water use (read in as 10^4 m^3 and converted to m^3) (m^3)

- real ∗8, dimension(:,:,:), allocatable parm::res_out

  measured average daily outflow from the reservoir for the month (needed if IRESCO=1) (read in as m^3/s and converted to m^3/day) (m^3/day)

- integer, dimension(:), allocatable parm::res_sub

  number of subbasin reservoir is in (weather for the subbasin is used for the reservoir) (none)

- integer, dimension(:), allocatable parm::ires1

  beginning of mid-year nutrient settling "season" (none)

- integer, dimension(:), allocatable parm::ires2

  end of mid-year nutrient settling "season" (none)

- integer, dimension(:), allocatable parm::iresco

  outflow simulation code (none):
  0 compute outflow for uncontrolled reservoir with average annual release rate
  1 measured monthly outflow
  2 simulated controlled outflow-target release
  3 measured daily outflow
  4 stage/volume/outflow relationship

- integer, dimension(:), allocatable parm::iyres

  year of the simulation that the reservoir becomes operational (none)

- integer, dimension(:), allocatable parm::mores

  month the reservoir becomes operational (none)

- integer, dimension(:,:), allocatable parm::iflodr

  iflodr(1,:) beginning month of non-flood season (needed if IRESCO=2) (none)
  iflodr(2,:) ending month of non-flood season (needed if IRESCO=2) (none)

- integer, dimension(:), allocatable parm::ndtargr

  number of days to reach target storage from current reservoir storage (needed if IRESCO=2) (days)

- real ∗8, dimension(:), allocatable parm::ap_ef

  application efficiency (0-1) (none)

- real ∗8, dimension(:), allocatable parm::decay_f

  exponential of the rate constant for degradation of the pesticide on foliage (none)

- real ∗8, dimension(:), allocatable parm::skoc

  soil adsorption coefficient normalized for soil organic carbon content ((mg/kg)/(mg/L))

- real ∗8, dimension(:), allocatable parm::decay_s

  exponential of the rate constant for degradation of the pesticide in soil (none)

- real ∗8, dimension(:), allocatable parm::hlife_f

  half-life of pesticide on foliage (days)

- real ∗8, dimension(:), allocatable parm::hlife_s

  half-life of pesticide in soil (days)

- real ∗8, dimension(:), allocatable parm::pst_wof

  fraction of pesticide on foliage which is washed-off by a rainfall event (none)

- real ∗8, dimension(:), allocatable parm::pst_wsol

  solubility of chemical in water (mg/L (ppm))

- real ∗8, dimension(:), allocatable parm::irramt

  depth of irrigation water applied to HRU (mm H2O)

- real ∗8, dimension(:), allocatable **parm::phusw**
- real ∗8, dimension(:), allocatable **parm::phusw_nocrop**
- integer, dimension(:), allocatable parm::pstflg

flag for types of pesticide used in watershed. Array location is pesticide ID number
0: pesticide not used
1: pesticide used

- integer, dimension(:), allocatable parm::nope

  sequence number of pesticide in NPNO(:) (none)
- integer, dimension(:), allocatable **parm::nop**
- integer, dimension(:), allocatable parm::isweep

  date of street sweeping operation (julian date)
- integer, dimension(:), allocatable **parm::yr_skip**
- integer, dimension(:), allocatable **parm::icrmx**
- integer, dimension(:), allocatable **parm::nopmx**
- integer, dimension(:,:), allocatable **parm::mgtop**
- integer, dimension(:,:), allocatable **parm::idop**
- integer, dimension(:,:), allocatable **parm::mgt1iop**
- integer, dimension(:,:), allocatable **parm::mgt2iop**
- integer, dimension(:,:), allocatable **parm::mgt3iop**
- real ∗8, dimension(:,:), allocatable **parm::mgt4op**
- real ∗8, dimension(:,:), allocatable **parm::mgt5op**
- real ∗8, dimension(:,:), allocatable **parm::mgt6op**
- real ∗8, dimension(:,:), allocatable **parm::mgt7op**
- real ∗8, dimension(:,:), allocatable **parm::mgt8op**
- real ∗8, dimension(:,:), allocatable **parm::mgt9op**
- real ∗8, dimension(:,:), allocatable **parm::mgt10iop**
- real ∗8, dimension(:,:), allocatable **parm::phu_op**
- real ∗8, dimension(:), allocatable parm::cnyld

  fraction of nitrogen in yield (kg N/kg yield)
- real ∗8, dimension(:), allocatable parm::rsdco_pl

  plant residue decomposition coefficient. The fraction of residue which will decompose in a day assuming optimal moisture, temperature, C:N ratio, and C:P ratio (none)
- real ∗8, dimension(:), allocatable parm::wac21

  1st shape parameter for radiation use efficiency equation (none)
- real ∗8, dimension(:), allocatable parm::wac22

  2nd shape parameter for radiation use efficiency equation (none)
- real ∗8, dimension(:), allocatable parm::alai_min

  minimum LAI during winter dormant period (m^2/m^2)
- real ∗8, dimension(:), allocatable parm::leaf1

  1st shape parameter for leaf area development equation (none)
- real ∗8, dimension(:), allocatable parm::leaf2

  2nd shape parameter for leaf area development equation (none)
- real ∗8, dimension(:), allocatable parm::wsyf

  Value of harvest index between 0 and HVSTI which represents the lowest value expected due to water stress ((kg/ha)/(kg/ha))
- real ∗8, dimension(:), allocatable parm::bio_e

  biomass-energy ratio. The potential (unstressed) growth rate per unit of intercepted photosynthetically active radiation ((kg/ha)/(MJ/m∗∗2))
- real ∗8, dimension(:), allocatable parm::hvsti

  harvest index: crop yield/aboveground biomass ((kg/ha)/(kg/ha))
- real ∗8, dimension(:), allocatable parm::t_base

  minimum temperature for plant growth (deg C)
- real ∗8, dimension(:), allocatable parm::t_opt

  optimal temperature for plant growth (deg C)
- real ∗8, dimension(:), allocatable parm::chtmx

  maximum canopy height (m)

- real ∗8, dimension(:), allocatable parm::cvm

  natural log of USLE_C (the minimum value of the USLE C factor for the land cover) (none)
- real ∗8, dimension(:), allocatable parm::gsi

  maximum stomatal conductance (m/s)
- real ∗8, dimension(:), allocatable parm::vpd2

  rate of decline in stomatal conductance per unit increase in vapor pressure deficit ((m/s)∗(1/kPa))
- real ∗8, dimension(:), allocatable parm::wavp

  rate of decline in radiation use efficiency as a function of vapor pressure deficit (none)
- real ∗8, dimension(:), allocatable parm::bio_leaf

  fraction of leaf/needle biomass that drops during dormancy (for trees only) (none)
- real ∗8, dimension(:), allocatable parm::blai

  maximum (potential) leaf area index (none)
- real ∗8, dimension(:), allocatable parm::cpyld

  fraction of phosphorus in yield (kg P/kg yield)
- real ∗8, dimension(:), allocatable parm::dlai

  fraction of growing season when leaf area declines (none)
- real ∗8, dimension(:), allocatable parm::rdmx

  maximum root depth of plant (m)
- real ∗8, dimension(:), allocatable parm::bio_n1

  1st shape parameter for plant N uptake equation (none)
- real ∗8, dimension(:), allocatable parm::bio_n2

  2nd shape parameter for plant N uptake equation (none)
- real ∗8, dimension(:), allocatable parm::bio_p1

  1st shape parameter for plant P uptake equation (none)
- real ∗8, dimension(:), allocatable parm::bio_p2

  2st shape parameter for plant P uptake equation (none)
- real ∗8, dimension(:), allocatable parm::bm_dieoff

  fraction above ground biomass that dies off at dormancy (fraction)
- real ∗8, dimension(:), allocatable **parm::bmx_trees**
- real ∗8, dimension(:), allocatable **parm::ext_coef**
- real ∗8, dimension(:), allocatable parm::rsr1

  initial root to shoot ratio at the beg of growing season
- real ∗8, dimension(:), allocatable parm::rsr2

  root to shoot ratio at the end of the growing season
- real ∗8, dimension(:), allocatable parm::pltnfr1

  nitrogen uptake parameter #1: normal fraction of N in crop biomass at emergence (kg N/kg biomass)
- real ∗8, dimension(:), allocatable parm::pltnfr2

  nitrogen uptake parameter #2: normal fraction of N in crop biomass at 0.5 maturity (kg N/kg biomass)
- real ∗8, dimension(:), allocatable parm::pltnfr3

  nitrogen uptake parameter #3: normal fraction of N in crop biomass at maturity (kg N/kg biomass)
- real ∗8, dimension(:), allocatable parm::pltpfr1

  phosphorus uptake parameter #1: normal fraction of P in crop biomass at emergence (kg P/kg biomass)
- real ∗8, dimension(:), allocatable parm::pltpfr2

  phosphorus uptake parameter #2: normal fraction of P in crop biomass at 0.5 maturity (kg P/kg biomass)
- real ∗8, dimension(:), allocatable parm::pltpfr3

  phosphorus uptake parameter #3: normal fraction of P in crop biomass at maturity (kg P/kg biomass)
- integer, dimension(:), allocatable parm::idc

crop/landcover category (none):
1 warm season annual legume
2 cold season annual legume
3 perennial legume
4 warm season annual
5 cold season annual
6 perennial
7 trees

- integer, dimension(:), allocatable **parm::mat_yrs**
- real ∗8, dimension(:), allocatable parm::bactpdb

  concentration of persistent bacteria in manure (fertilizer) (cfu/g manure)
- real ∗8, dimension(:), allocatable parm::fminn

  fraction of fertilize/manure that is mineral nitrogen (NO3 + NH3) (kg minN/kg fert)
- real ∗8, dimension(:), allocatable parm::forgn

  fraction of organic nitrogen in fertilizer/manure (kg orgN/kg fert)
- real ∗8, dimension(:), allocatable parm::forgp

  fraction of fertilizer/manure that is organic phosphorus (kg orgP/kg fert)
- real ∗8, dimension(:), allocatable parm::bactkddb

  fraction of bacteria in solution (the remaining fraction is sorbed to soil particles) (none):
  1: all bacteria in solution
  0: all bacteria sorbed to soil particles
- real ∗8, dimension(:), allocatable parm::bactlpdb

  concentration of less persistent bacteria in manure (fertilizer) (cfu/g manure)
- real ∗8, dimension(:), allocatable parm::fminp

  fraction of fertilizer that is mineral phosphorus in fertilizer/manure (kg minP/kg fert)
- real ∗8, dimension(:), allocatable parm::fnh3n

  fraction of mineral N content that is NH3-N in fertilizer/manure (kg NH3-N/kg minN)
- character(len=8), dimension(200) parm::fertnm

  name of fertilizer
- real ∗8, dimension(:), allocatable parm::curbden

  curb length density in HRU (km/ha)
- real ∗8, dimension(:), allocatable parm::dirtmx

  maximum amount of solids allowed to build up on impervious surfaces (kg/curb km)
- real ∗8, dimension(:), allocatable parm::fimp

  fraction of HRU area that is impervious (both directly and indirectly connected) (fraction)
- real ∗8, dimension(:), allocatable parm::urbcoef

  wash-off coefficient for removal of constituents from an impervious surface (1/mm)
- real ∗8, dimension(:), allocatable parm::thalf

  time for the amount of solids on impervious areas to build up to 1/2 the maximum level (days)
- real ∗8, dimension(:), allocatable parm::tnconc

  concentration of total nitrogen in suspended solid load from impervious areas (mg N/kg sed)
- real ∗8, dimension(:), allocatable parm::tno3conc

  concentration of NO3-N in suspended solid load from impervious areas (mg NO3-N/kg sed)
- real ∗8, dimension(:), allocatable parm::tpconc

  concentration of total phosphorus in suspended solid load from impervious areas (mg P/kg sed)
- real ∗8, dimension(:), allocatable parm::fcimp

  fraction of HRU area that is classified as directly connected impervious (fraction)
- real ∗8, dimension(:), allocatable parm::urbcn2

  SCS curve number for moisture condition II in impervious areas (none)
- real ∗8 parm::fr_curb

  availability factor, the fraction of the curb length that is sweepable (none)
- real ∗8 parm::frt_kg

  amount of fertilizer applied to HRU (kg/ha)

- real ∗8 parm::pst_dep

    depth of pesticide in the soil (mm)
- real ∗8 parm::sweepeff

    removal efficiency of sweeping operation (none)
- real ∗8, dimension(:), allocatable parm::ranrns_hru

    random roughness for a given HRU (mm)
- integer, dimension(:), allocatable **parm::itill**
- real ∗8, dimension(:), allocatable parm::deptil

    depth of mixing caused by tillage operation (mm)
- real ∗8, dimension(:), allocatable parm::effmix

    mixing efficiency of tillage operation (none)
- real ∗8, dimension(:), allocatable parm::ranrns

    random roughness of a given tillage operation (mm)
- character(len=8), dimension(550) parm::tillnm

    8-character name for the tillage operation
- real ∗8, dimension(:), allocatable parm::rnum1s

    For ICODES equal to (none)
    0,1,3,5,9: not used
    2: fraction of overland flow in channel
    4: amount of water transferred (as defined by INUM4S)
    7,8,10,11: drainage area in square kilometers associated with the record file
    12: rearation coefficient.
- real ∗8, dimension(:), allocatable parm::hyd_dakm

    total drainage area of hydrograph in square kilometers (km^2)
- real ∗8, dimension(:,:), allocatable parm::shyd

    shyd(1,:) water (m^3 H2O)
    shyd(2,:) sediment or suspended solid load (metric tons)
    shyd(3,:) organic nitrogen (kg N)
    shyd(4,:) organic phosphorus (kg P)
    shyd(5,:) nitrate (kg N)
    shyd(6,:) soluble phosphorus (kg P)
    shyd(7,:) soluble pesticides (kg P)
    shyd(8,:) sorbed pesticides (kg P)
- real ∗8, dimension(:,:), allocatable parm::varoute

    varoute(:,:) daily routing storage array (varies):
    varoute(1,:) temperature (deg C)
    varoute(2,:) water (m^3 H2O)
    varoute(3,:) sediment or suspended solid load (metric tons)
    varoute(4,:) organic nitrogen (kg N)
    varoute(5,:) organic phosphorus (kg P)
    varoute(6,:) nitrate (kg N)
    varoute(7,:) mineral phosphorus (kg P)
    varoute(11,:) pesticide in solution (mg pst)
    varoute(12,:) pesticide sorbed to sediment (mg pst)
    varoute(13,:) chlorophyll-a (kg)
    varoute(14,:) ammonium (kg N)
    varoute(15,:) nitrite (kg N)
    varoute(16,:) carbonaceous biological oxygen demand (kg)
    varoute(17,:) dissolved oxygen (kg)
    varoute(18,:) persistent bacteria (# cfu/100ml)
    varoute(19,:) less persistent bacteria (# cfu/100ml) varoute(20,:) conservative metal #1 (kg) varoute(21,:) conservative metal #2 (kg) varoute(22,:) conservative metal #3 (kg)
- real ∗8, dimension(:,:), allocatable **parm::vartran**
- real ∗8, dimension(:,:,:), allocatable parm::hhvaroute

    routing storage array for hourly time step (varies)
    hhvaroute(1,:,:) temperature (deg C)
    hhvaroute(2,:,:) water (m^3 H2O)

hhvaroute(3,:,:) sediment or suspended solid load (metric tons)
hhvaroute(4,:,:) organic nitrogen (kg N)
hhvaroute(5,:,:) organic posphorus (kg P)
hhvaroute(6,:,:) nitrate (kg N)
hhvaroute(7,:,:) soluble mineral phosphorus (kg P)
hhvaroute(11,:,:) pesticide in solution (mg pst)
hhvaroute(12,:,:) pesticide sorbed to sediment (mg pst)
hhvaroute(13,:,:) chlorophyll-a (kg)
hhvaroute(14,:,:) ammonium (kg N)
hhvaroute(15,:,:) nitrite (kg N)
hhvaroute(16,:,:) carbonaceous biological oxygen demand (kg)
hhvaroute(17,:,:) dissolved oxygen (kg O2)
hhvaroute(18,:,:) persistent bacteria (# cfu/100ml)
hhvaroute(19,:,:) less persistent bacteria (# cfu/100ml)
hhvaroute(20,:,:) conservative metal #1 (kg)
hhvaroute(21,:,:) conservative metal #2 (kg)
hhvaroute(22,:,:) conservative metal #3 (kg)

- integer, dimension(:), allocatable parm::icodes

  routing command code (none):
  0 = finish
  1 = subbasin
  2 = route
  3 = routres
  4 = transfer
  5 = add
  6 = rechour
  7 = recmon
  8 = recyear
  9 = save
  10 = recday
  11 = reccnst
  12 = structure
  13 = apex
  14 = saveconc
  15 =
  16 = autocal
  17 = routing unit

- integer, dimension(:), allocatable parm::ihouts

  For ICODES equal to (none)
  0: not used
  1,2,3,5,7,8,10,11: hydrograph storage location number
  4: departure type (1=reach, 2=reservoir)
  9: hydrograph storage location of data to be printed to event file
  14:hydrograph storage location of data to be printed to saveconc file.

- integer, dimension(:), allocatable parm::inum1s

  For ICODES equal to (none)
  0: not used
  1: subbasin number
  2: reach number
  3: reservoir number
  4: reach or res # flow is diverted from
  5: hydrograph storage location of 1st dataset to be added
  7,8,9,10,11,14: file number.

- integer, dimension(:), allocatable parm::inum2s

  For ICODES equal to (none)
  0,1,7,8,10,11: not used
  2,3: inflow hydrograph storage location
  4: destination type (1=reach, 2=reservoir)
  5: hydrograph storage location of 2nd dataset to be added
  9,14:print frequency (0=daily, 1=hourly)

- integer, dimension(:), allocatable parm::inum3s

For ICODES equal to (none)
0,1,5,7,8,10,11: not used
2,3: subbasin number 4: destination number. Reach or reservoir receiving water
9: print format (0=normal, fixed format; 1=txt format for AV interface, recday)

- integer, dimension(:), allocatable parm::inum4s

  For ICODES equal to (none)
  0,2,3,5,7,8,9,10,11: not used
  1: GIS code printed to output file (optional)
  4: rule code governing transfer of water (1=fraction transferred out, 2=min volume or flow left, 3=exact amount transferred)

- integer, dimension(:), allocatable **parm::inum5s**
- integer, dimension(:), allocatable **parm::inum6s**
- integer, dimension(:), allocatable **parm::inum7s**
- integer, dimension(:), allocatable **parm::inum8s**
- integer, dimension(:), allocatable **parm::subed**
- character(len=10), dimension(:), allocatable **parm::recmonps**
- character(len=10), dimension(:), allocatable **parm::reccnstps**
- character(len=5), dimension(:), allocatable **parm::subnum**
- character(len=4), dimension(:), allocatable **parm::hruno**
- real ∗8, dimension(:), allocatable parm::grwat_n

  Mannings's n for grassed waterway (none)

- integer, dimension(:), allocatable parm::grwat_i

  flag for the simulation of grass waterways (none)
  = 0 inactive
  = 1 active

- real ∗8, dimension(:), allocatable parm::grwat_l

  length of grass waterway (km)

- real ∗8, dimension(:), allocatable parm::grwat_w

  average width of grassed waterway (m)

- real ∗8, dimension(:), allocatable parm::grwat_d

  depth of grassed waterway from top of bank to bottom (m)

- real ∗8, dimension(:), allocatable parm::grwat_s

  average slope of grassed waterway channel (m)

- real ∗8, dimension(:), allocatable parm::grwat_spcon

  linear parameter defined by user for calculating sediment transport in grassed waterways (none)

- real ∗8, dimension(:), allocatable parm::tc_gwat

  time of concentration for grassed waterway and its drainage area (none)

- real ∗8, dimension(:), allocatable **parm::pot_volmm**
- real ∗8, dimension(:), allocatable **parm::pot_tilemm**
- real ∗8, dimension(:), allocatable **parm::pot_volxmm**
- real ∗8, dimension(:), allocatable parm::pot_fr

  fraction of HRU area that drains into pothole (km^2/km^2)

- real ∗8, dimension(:), allocatable parm::pot_tile

  average daily outflow to main channel from tile flow if drainage tiles are installed in pothole (needed only if current HRU is IPOT) (m^3/s)

- real ∗8, dimension(:), allocatable parm::pot_vol

  initial or current volume of water stored in the depression/impounded area (read in as mm and converted to m^3) (needed only if current HRU is IPOT) (mm or m^3 H20)

- real ∗8, dimension(:), allocatable parm::potsa

  surface area of impounded water body (ha)

- real ∗8, dimension(:), allocatable parm::pot_volx

  maximum volume of water stored in the depression/impounded area (read in as mm and converted to m^3) (needed only if current HRU is IPOT) (mm)

- real ∗8, dimension(:), allocatable parm::wfsh

wetting front matric potential (average capillary suction at wetting front) (mm)
- real ∗8, dimension(:), allocatable parm::potflwi

  water entering pothole on day (m^3 H2O)
- real ∗8, dimension(:), allocatable parm::potsedi

  sediment entering pothole on day (metric tons)
- real ∗8, dimension(:), allocatable parm::pot_no3l

  nitrate decay rate in impounded area (1/day)
- real ∗8, dimension(:), allocatable parm::pot_nsed

  normal sediment concentration in impounded water (needed only if current HRU is IPOT)(mg/L)
- real ∗8, dimension(:), allocatable parm::gwno3

  nitrate-N concentration in groundwater loading to reach (mg N/L)
- real ∗8, dimension(:), allocatable parm::newrti

  infiltration rate for last time step from the previous day (mm/hr)
- real ∗8, dimension(:), allocatable parm::fsred

  reduction in bacteria loading from filter strip (none)
- real ∗8, dimension(:), allocatable parm::pot_no3

  amount of nitrate in pothole water body (kg N)
- real ∗8, dimension(:), allocatable parm::pot_sed

  amount of sediment in pothole water body (metric tons)
- real ∗8, dimension(:), allocatable **parm::tmpavp**
- real ∗8, dimension(:), allocatable parm::dis_stream

  average distance to stream (m)
- real ∗8, dimension(:), allocatable parm::evpot

  pothole evaporation coefficient (none)
- real ∗8, dimension(:), allocatable **parm::pot_solpl**
- real ∗8, dimension(:), allocatable **parm::sed_con**
- real ∗8, dimension(:), allocatable **parm::orgn_con**
- real ∗8, dimension(:), allocatable **parm::orgp_con**
- real ∗8, dimension(:), allocatable parm::pot_k

  hydraulic conductivity of soil surface of pothole `defaults to conductivity of upper soil (0.↩ 01-10.) layer`
- real ∗8, dimension(:), allocatable **parm::soln_con**
- real ∗8, dimension(:), allocatable **parm::solp_con**
- real ∗8, dimension(:), allocatable parm::n_reduc

  nitrogen uptake reduction factor (not currently used; defaulted 300.)
- real ∗8, dimension(:), allocatable parm::n_lag

  lag coefficient for calculating nitrate concentration in subsurface drains (0.001 - 1.0) (dimensionless)
- real ∗8, dimension(:), allocatable parm::n_ln

  power function exponent for calculating nitrate concentration in subsurface drains (1.0 - 3.0) (dimensionless)
- real ∗8, dimension(:), allocatable parm::n_lnco

  coefficient for power function for calculating nitrate concentration in subsurface drains (0.5 - 4.0) (dimensionless)
- integer, dimension(:), allocatable **parm::ioper**
- integer, dimension(:), allocatable **parm::ngrwat**
- real ∗8, dimension(:), allocatable parm::usle_ls

  USLE equation length slope (LS) factor (none)
- real ∗8, dimension(:), allocatable parm::filterw

  filter strip width for bacteria transport (m)
- real ∗8, dimension(:), allocatable parm::phuacc

  fraction of plant heat units accumulated (none)
- real ∗8, dimension(:), allocatable parm::sumix

  sum of all tillage mixing efficiencies for HRU operation (none)
- real ∗8, dimension(:), allocatable parm::epco

plant water uptake compensation factor (0-1) (none)
- real ∗8, dimension(:), allocatable parm::esco

  soil evaporation compensation factor (0-1) (none)
- real ∗8, dimension(:), allocatable parm::hru_slp

  average slope steepness in HRU (m/m)
- real ∗8, dimension(:), allocatable parm::slsubbsn

  average slope length for subbasin (m)
- real ∗8, dimension(:), allocatable parm::erorgn

  organic N enrichment ratio, if left blank the model will calculate for every event (none)
- real ∗8, dimension(:), allocatable parm::erorgp

  organic P enrichment ratio, if left blank the model will calculate for every event (none)
- real ∗8, dimension(:), allocatable parm::biomix

  biological mixing efficiency. Mixing of soil due to activity of earthworms and other soil biota. Mixing is performed at the end of every calendar year (none)
- real ∗8, dimension(:), allocatable parm::pnd_seci

  secchi-disk depth of pond (m)
- real ∗8, dimension(:), allocatable parm::canmx

  maximum canopy storage (mm H2O)
- real ∗8, dimension(:), allocatable parm::divmax

  maximum daily irrigation diversion from the reach (when IRRSC=1 or IRR=3): when value is positive the units are mm H2O; when the value is negative, the units are (10^4 m^3 H2O) (mm H2O or 10^4 m^3 H2O)
- real ∗8, dimension(:), allocatable parm::flowmin

  minimum instream flow for irrigation diversions when IRRSC=1, irrigation water will be diverted only when streamflow is at or above FLOWMIN (m^3/s)
- real ∗8, dimension(:), allocatable parm::usle_p

  USLE equation support practice (P) factor (none)
- real ∗8, dimension(:), allocatable parm::lat_sed

  sediment concentration in lateral flow (g/L)
- real ∗8, dimension(:), allocatable parm::rch_dakm

  total drainage area contributing to flow at the outlet (pour point) of the reach in square kilometers (km^2)
- real ∗8, dimension(:), allocatable parm::cn1

  SCS runoff curve number for moisture condition I (none)
- real ∗8, dimension(:), allocatable parm::pnd_no3s

  amount of nitrate originating from lateral flow in pond at end of day or at beginning of day(kg N)
- real ∗8, dimension(:), allocatable parm::lat_ttime

  lateral flow travel time or exponential of the lateral flow travel time (days or none)
- real ∗8, dimension(:), allocatable parm::cn2

  SCS runoff curve number for moisture condition II (none)
- real ∗8, dimension(:), allocatable parm::flowfr

  fraction of available flow in reach that is allowed to be applied to the HRU (none)
- real ∗8, dimension(:), allocatable parm::sol_zmx

  maximum rooting depth (mm)
- real ∗8, dimension(:), allocatable parm::tile_ttime

  exponential of the tile flow travel time (none)
- real ∗8, dimension(:), allocatable parm::slsoil

  slope length for lateral subsurface flow (m)
- real ∗8, dimension(:), allocatable parm::gwminp

  soluble P concentration in groundwater loading to reach (mg P/L)
- real ∗8, dimension(:), allocatable parm::sol_cov

  amount of residue on soil surface (kg/ha)
- real ∗8, dimension(:), allocatable parm::sed_stl

fraction of sediment remaining suspended in impoundment after settling for one day (kg/kg)

- real ∗8, dimension(:), allocatable parm::ov_n

  Manning's "n" value for overland flow (none)

- real ∗8, dimension(:), allocatable parm::pnd_no3

  amount of nitrate originating from surface runoff in pond at end of day or at beginning of day (kg N)

- real ∗8, dimension(:), allocatable parm::pnd_solp

  amount of soluble P originating from surface runoff in pond at end of day or at beginning of day (kg P)

- real ∗8, dimension(:), allocatable parm::yldanu

  annual yield (dry weight) in the HRU (metric tons/ha)

- real ∗8, dimension(:), allocatable parm::driftco

  coefficient for pesticide drift directly onto stream (none)

- real ∗8, dimension(:), allocatable parm::pnd_orgn

  amount of organic N originating from surface runoff in pond at end of day or at beginning of day (kg N)

- real ∗8, dimension(:), allocatable parm::pnd_orgp

  amount of organic P originating from surface runoff in pond at end of day or at beginning of day (kg P)

- real ∗8, dimension(:), allocatable parm::cn3

  SCS runoff curve number for moisture condition III (none)

- real ∗8, dimension(:), allocatable parm::twlpnd

  water lost through seepage from ponds on day in HRU (mm H2O)

- real ∗8, dimension(:), allocatable parm::twlwet

  water lost through seepage from wetlands on day in HRU (mm H2O)

- real ∗8, dimension(:), allocatable parm::hru_fr

  fraction of subbasin area contained in HRU (km^2/km^2)

- real ∗8, dimension(:), allocatable parm::sol_sumul

  amount of water held in soil profile at saturation (mm H2O)

- real ∗8, dimension(:), allocatable parm::pnd_chla

  amount of chlorophyll-a in pond at end of day (kg chl_a)

- real ∗8, dimension(:), allocatable parm::hru_km

  area of HRU in square kilometers (km^2)

- real ∗8, dimension(:), allocatable parm::bio_ms

  land cover/crop biomass (dry weight) (kg/ha)

- real ∗8, dimension(:), allocatable parm::sol_alb

  albedo when soil is moist (none)

- real ∗8, dimension(:), allocatable parm::strsw

  fraction of potential plant growth achieved on the day where the reduction is caused by water stress (none)

- real ∗8, dimension(:), allocatable parm::pnd_fr

  fraction of HRU/subbasin area that drains into ponds (none)

- real ∗8, dimension(:), allocatable parm::pnd_k

  hydraulic conductivity through bottom of ponds (mm/hr)

- real ∗8, dimension(:), allocatable parm::pnd_psa

  surface area of ponds when filled to principal spillway (ha)

- real ∗8, dimension(:), allocatable parm::pnd_pvol

  runoff volume of water from catchment area needed to fill the ponds to the principal spillway (UNIT CHANGE!) (10^4 m^3 H2O or m^3 H2O)

- real ∗8, dimension(:), allocatable parm::pnd_esa

  surface area of ponds when filled to emergency spillway (ha)

- real ∗8, dimension(:), allocatable parm::pnd_evol

  runoff volume of water from catchment area needed to fill the ponds to the emergency spillway (UNIT CHANGE!) (10^4 m^3 H2O or m^3 H2O)

- real ∗8, dimension(:), allocatable parm::pnd_vol

  volume of water in ponds (UNIT CHANGE!) (10^4 m^3 H2O or m^3 H2O)

- real ∗8, dimension(:), allocatable parm::yldaa

  average annual yield (dry weight) in the HRU (metric tons)
- real ∗8, dimension(:), allocatable parm::pnd_nsed

  normal sediment concentration in pond water (UNIT CHANGE!) (mg/kg or kg/kg)
- real ∗8, dimension(:), allocatable parm::pnd_sed

  sediment concentration in pond water (UNIT CHANGE!) (mg/kg or kg/kg)
- real ∗8, dimension(:), allocatable parm::dep_imp

  depth to impervious layer (mm)
- real ∗8, dimension(:), allocatable **parm::strsa**
- real ∗8, dimension(:), allocatable **parm::evpnd**
- real ∗8, dimension(:), allocatable **parm::evwet**
- real ∗8, dimension(:), allocatable parm::wet_fr

  fraction of HRU/subbasin area that drains into wetlands (none)
- real ∗8, dimension(:), allocatable parm::wet_k

  hydraulic conductivity of bottom of wetlands (mm/hr)
- real ∗8, dimension(:), allocatable parm::wet_nsa

  surface area of wetlands in subbasin at normal water level (ha)
- real ∗8, dimension(:), allocatable parm::wet_nvol

  runoff volume of water from catchment area needed to fill wetlands to normal water level (UNIT CHANGE!) (10^4 m^3 H2O or m^3 H2O)
- integer, dimension(:), allocatable **parm::iwetgw**
- integer, dimension(:), allocatable **parm::iwetile**
- real ∗8, dimension(:), allocatable parm::wet_mxsa

  surface area of wetlands at maximum water level (ha)
- real ∗8, dimension(:), allocatable parm::wet_mxvol

  runoff volume of water from catchment area needed to fill wetlands to maximum water level (UNIT CHANGE!) (10^4 m^3 H2O or m^3 H2O)
- real ∗8, dimension(:), allocatable parm::wet_vol

  volume of water in wetlands (UNIT CHANGE!) (10^4 m^3 H2O or m^3 H2O)
- real ∗8, dimension(:), allocatable parm::wet_nsed

  normal sediment concentration in wetland water (UNIT CHANGE!) (mg/kg or kg/kg)
- real ∗8, dimension(:), allocatable parm::wet_sed

  sediment concentration in wetland water (UNIT CHANGE!) (mg/L or kg/L)
- real ∗8, dimension(:,:), allocatable parm::bp

  bp(1,:) 1st shape parameter for the pond surface area equation (none)
  bp(2,:) 2nd shape parameter for the pond surface area equation (none)
- real ∗8, dimension(:), allocatable parm::sci

  retention coefficient for CN method based on plant ET (none)
- real ∗8, dimension(:), allocatable parm::smx

  retention coefficient for CN method based on soil moisture (none)
- real ∗8, dimension(:,:), allocatable parm::bw

  bw(1,:) 1st shape parameter for the wetland surface area equation (none)
  bw(2,:) 2nd shape parameter for the wetland surface area equation (none)
- real ∗8, dimension(:), allocatable parm::bactpq

  persistent bacteria in soil solution (# cfu/m^2)
- real ∗8, dimension(:), allocatable parm::cnday

  curve number for current day, HRU and at current soil moisture (none)
- real ∗8, dimension(:), allocatable parm::bactlp_plt

  less persistent bacteria on foliage (# cfu/m^2)
- real ∗8, dimension(:), allocatable parm::bactp_plt

  persistent bacteria on foliage (# cfu/m^2)
- real ∗8, dimension(:), allocatable parm::auto_eff

fertilizer application efficiency calculated as the amount of N applied divided by the amount of N removed at harvest (none)

- real ∗8, dimension(:), allocatable parm::secciw

  water clarity coefficient for wetland (none)
- real ∗8, dimension(:), allocatable parm::sol_sw

  amount of water stored in soil profile at end of any given day (mm H2O)
- real ∗8, dimension(:), allocatable parm::bactlpq

  less persistent bacteria in soil solution (# cfu/m^2)
- real ∗8, dimension(:), allocatable parm::chlaw

  chlorophyll-a production coefficient for wetland (none)
- real ∗8, dimension(:), allocatable parm::tmpav

  average air temperature on current day in HRU (deg C)
- real ∗8, dimension(:), allocatable parm::bactlps

  less persistent bacteria attached to soil particles (# cfu/m^2)
- real ∗8, dimension(:), allocatable parm::bactps

  persistent bacteria attached to soil particles (# cfu/m^2)
- real ∗8, dimension(:), allocatable parm::sno_hru

  amount of water stored as snow in HRU on current day (mm H2O)
- real ∗8, dimension(:), allocatable parm::wet_orgn

  amount of organic N originating from surface runoff in wetland at end of day (kg N)
- real ∗8, dimension(:), allocatable parm::hru_ra

  solar radiation for the day in HRU (MJ/m^2)
- real ∗8, dimension(:), allocatable parm::subp

  precipitation for the day in HRU (mm H2O)
- real ∗8, dimension(:), allocatable parm::rsdin

  initial residue cover (kg/ha)
- real ∗8, dimension(:), allocatable parm::tmn

  minimum air temperature on current day in HRU (deg C)
- real ∗8, dimension(:), allocatable parm::tmx

  maximum air temperature on current day in HRU (deg C)
- real ∗8, dimension(:), allocatable parm::tmp_hi

  last maximum temperature in HRU (deg C)
- real ∗8, dimension(:), allocatable parm::tmp_lo

  last minimum temperature in HRU (deg C)
- real ∗8, dimension(:), allocatable parm::usle_k

  USLE equation soil erodibility (K) factor (none)
- real ∗8, dimension(:), allocatable parm::tconc

  time of concentration for HRU (hour)
- real ∗8, dimension(:), allocatable parm::hru_rmx

  maximum possible solar radiation for the day in HRU (MJ/m^2)
- real ∗8, dimension(:), allocatable parm::rwt

  fraction of total plant biomass that is in roots (none)
- real ∗8, dimension(:), allocatable **parm::olai**
- real ∗8, dimension(:), allocatable **parm::usle_cfac**
- real ∗8, dimension(:), allocatable **parm::usle_eifac**
- real ∗8, dimension(:), allocatable parm::sol_sumfc

  amount of water held in soil profile at field capacity (mm H2O)
- real ∗8, dimension(:), allocatable parm::t_ov

  time for flow from farthest point in subbasin to enter a channel (hour)
- real ∗8, dimension(:), allocatable parm::anano3

  total amount of NO3 applied during the year in auto-fertilization (kg N/ha)

- real ∗8, dimension(:), allocatable parm::aird

  amount of water applied to HRU on current day (mm H2O)
- real ∗8, dimension(:), allocatable parm::wet_orgp

  amount of organic P originating from surface runoff in wetland at end of day (kg P)
- real ∗8, dimension(:), allocatable parm::sol_avpor

  average porosity for entire soil profile (none)
- real ∗8, dimension(:), allocatable parm::usle_mult

  product of USLE K,P,LS,exp(rock) (none)
- real ∗8, dimension(:), allocatable parm::rhd

  relative humidity for the day in HRU (none)
- real ∗8, dimension(:), allocatable parm::u10

  wind speed (measured at 10 meters above surface) for the day in HRU (m/s)
- real ∗8, dimension(:), allocatable parm::cht

  canopy height (m)
- real ∗8, dimension(:), allocatable parm::aairr

  average annual amount of irrigation water applied to HRU (mm H2O)
- real ∗8, dimension(:), allocatable parm::lai_aamx

  maximum leaf area index for the entire period of simulation in the HRU (none)
- real ∗8, dimension(:), allocatable parm::deepirr

  amount of water removed from deep aquifer for irrigation (mm H2O)
- real ∗8, dimension(:), allocatable parm::shallirr

  amount of water removed from shallow aquifer for irrigation (mm H2O)
- real ∗8, dimension(:), allocatable parm::wet_no3

  amount of nitrate originating from surface runoff in wetland at end of day (kg N)
- real ∗8, dimension(:), allocatable parm::ovrlnd

  overland flow onto HRU from upstream routing unit (mm H2O)
- real ∗8, dimension(:), allocatable parm::canstor

  amount of water held in canopy storage (mm H2O)
- real ∗8, dimension(:), allocatable parm::irr_mx

  maximum irrigation amount per auto application (mm)
- real ∗8, dimension(:), allocatable parm::auto_wstr

  water stress factor which triggers auto irrigation (none or mm)
- real ∗8, dimension(:), allocatable parm::cfrt_id

  fertilizer/manure identification number from database (fert.dat) (none)
- real ∗8, dimension(:), allocatable parm::cfrt_kg

  amount of fertilzier/manure applied to HRU on a given day ((kg/ha)/day)
- real ∗8, dimension(:), allocatable **parm::cpst_id**
- real ∗8, dimension(:), allocatable **parm::cpst_kg**
- real ∗8, dimension(:), allocatable parm::irr_asq

  surface runoff ratio
- real ∗8, dimension(:), allocatable **parm::irr_eff**
- real ∗8, dimension(:), allocatable parm::irrsq

  surface runoff ratio (0-1) .1 is 10% surface runoff (frac)
- real ∗8, dimension(:), allocatable parm::irrsalt

  concentration of salt in irrigation water (mg/kg)
- real ∗8, dimension(:), allocatable **parm::irrefm**
- real ∗8, dimension(:), allocatable parm::bio_eat

  dry weight of biomass removed by grazing daily ((kg/ha)/day)
- real ∗8, dimension(:), allocatable parm::bio_trmp

  dry weight of biomass removed by trampling daily ((kg/ha)/day)
- integer, dimension(:), allocatable parm::ipst_freq

number of days between applications (days)

- integer, dimension(:), allocatable parm::ifrt_freq

  number of days between applications in continuous fertlizer operation (days)
- integer, dimension(:), allocatable **parm::irr_noa**
- integer, dimension(:), allocatable **parm::irr_sc**
- integer, dimension(:), allocatable **parm::irr_no**
- integer, dimension(:), allocatable parm::imp_trig

  release/impound action code (none):
  0 begin impounding water
  1 release impounded water
- integer, dimension(:), allocatable parm::fert_days

  number of days continuous fertilization will be simulated (none)
- integer, dimension(:), allocatable **parm::irr_sca**
- integer, dimension(:), allocatable parm::idplt

  land cover/crop identification code for first crop grown in HRU (the only crop if there is no rotation) (from crop.dat) (none)
- integer, dimension(:), allocatable parm::wstrs_id

  water stress identifier (none):
  1 plant water demand
  2 soil water deficit
- integer, dimension(:), allocatable **parm::pest_days**
- real ∗8, dimension(:,:), allocatable **parm::bio_aahv**
- real ∗8, dimension(:), allocatable **parm::cumei**
- real ∗8, dimension(:), allocatable **parm::cumeira**
- real ∗8, dimension(:), allocatable **parm::cumrt**
- real ∗8, dimension(:), allocatable **parm::cumrai**
- real ∗8, dimension(:), allocatable parm::wet_solp

  amount of soluble P originating from surface runoff in wetland at end of day (kg P)
- real ∗8, dimension(:), allocatable parm::wet_chla

  amount of chlorophyll-a in wetland at end of day (kg chla)
- real ∗8, dimension(:), allocatable parm::wet_no3s

  amount of nitrate originating from lateral flow in wetland at end of day (kg N)
- real ∗8, dimension(:), allocatable parm::pstsol

  amount of soluble pesticide leached from bottom of soil profile on current day (kg pst/ha)
- real ∗8, dimension(:), allocatable parm::pnd_no3g

  amount of nitrate originating from groundwater in pond at end of day or at beginning of day (kg N)
- real ∗8, dimension(:), allocatable parm::wet_seci

  secchi-disk depth in wetland at end of day (m)
- real ∗8, dimension(:), allocatable parm::delay

  groundwater delay: time required for water leaving the bottom of the root zone to reach the shallow aquifer (days)
- real ∗8, dimension(:), allocatable parm::gwht

  groundwater height (m)
- real ∗8, dimension(:), allocatable parm::gw_q

  groundwater contribution to streamflow from HRU on current day (mm H2O)
- real ∗8, dimension(:), allocatable parm::pnd_solpg

  amount of soluble P originating from groundwater in pond at end of day or at beginning of day (kg P)
- real ∗8, dimension(:), allocatable parm::alpha_bf

  alpha factor for groundwater recession curve (1/days)
- real ∗8, dimension(:), allocatable parm::alpha_bfe

  $\exp(-alpha_bf)$ *(none)*
- real ∗8, dimension(:), allocatable parm::gw_spyld

  specific yield for shallow aquifer (m^3/m^3)

- real ∗8, dimension(:), allocatable parm::alpha_bf_d

  alpha factor for groudwater recession curve of the deep aquifer (1/days)
- real ∗8, dimension(:), allocatable parm::alpha_bfe_d

  $\exp(-alpha_b f_d)$ *for deep aquifer (none)*
- real ∗8, dimension(:), allocatable parm::gw_qdeep

  groundwater contribution to streamflow from deep aquifer from HRU on current day (mm H2O)
- real ∗8, dimension(:), allocatable parm::gw_delaye

  $\exp(-1/delay)$ *where delay(:) is the groundwater delay (time required for water leaving the bottom of the root zone to reach the shallow aquifer; units-days) (none)*
- real ∗8, dimension(:), allocatable parm::gw_revap

  revap coeff: this variable controls the amount of water moving from the shallow aquifer to the root zone as a result of soil moisture depletion (none)
- real ∗8, dimension(:), allocatable parm::rchrg_dp

  recharge to deep aquifer: the fraction of root zone percolation that reaches the deep aquifer (none)
- real ∗8, dimension(:), allocatable parm::anion_excl

  fraction of porosity from which anions are excluded
- real ∗8, dimension(:), allocatable parm::revapmn

  threshold depth of water in shallow aquifer required to allow revap to occur (mm H2O)
- real ∗8, dimension(:), allocatable parm::rchrg

  amount of water recharging both aquifers on current day in HRU (mm H2O)
- real ∗8, dimension(:), allocatable parm::bio_min

  minimum plant biomass for grazing (kg/ha)
- real ∗8, dimension(:), allocatable parm::ffc

  initial HRU soil water content expressed as fraction of field capacity (none)
- real ∗8, dimension(:), allocatable parm::surqsolp

  amount of soluble phosphorus in surface runoff in HRU for the day (kg P/ha)
- real ∗8, dimension(:), allocatable parm::deepst

  depth of water in deep aquifer (mm H2O)
- real ∗8, dimension(:), allocatable parm::shallst

  depth of water in shallow aquifer in HRU (mm H2O)
- real ∗8, dimension(:), allocatable parm::wet_solpg

  amount of soluble P originating from groundwater in wetland at end of day (kg P)
- real ∗8, dimension(:), allocatable **parm::cklsp**
- real ∗8, dimension(:), allocatable **parm::rchrg_src**
- real ∗8, dimension(:), allocatable parm::trapeff

  filter strip trapping efficiency (used for everything but bacteria) (none)
- real ∗8, dimension(:), allocatable parm::sol_avbd

  average bulk density for soil profile (Mg/m^3)
- real ∗8, dimension(:), allocatable parm::wet_no3g

  amount of nitrate originating from groundwater in wetland at end of day (kg N)
- real ∗8, dimension(:), allocatable parm::tdrain

  time to drain soil to field capacity yield used in autofertilization (hours)
- real ∗8, dimension(:), allocatable parm::gwqmn

  threshold depth of water in shallow aquifer required before groundwater flow will occur (mm H2O)
- real ∗8, dimension(:), allocatable parm::snotmp

  temperature of snow pack in HRU (deg C)
- real ∗8, dimension(:), allocatable parm::pplnt

  plant uptake of phosphorus in HRU for the day (kg P/ha)
- real ∗8, dimension(:), allocatable parm::gdrain

  drain tile lag time: the amount of time between the transfer of water from the soil to the drain tile and the release of the water from the drain tile to the reach (hours)

- real ∗8, dimension(:), allocatable parm::ddrain

  depth of drain tube from the soil surface (mm)
- real ∗8, dimension(:), allocatable parm::sol_crk

  crack volume potential of soil (none)
- real ∗8, dimension(:), allocatable parm::brt

  fraction of surface runoff within the subbasin which takes 1 day or less to reach the subbasin outlet (none)
- real ∗8, dimension(:), allocatable parm::dayl

  length of the current day (hours)
- real ∗8, dimension(:), allocatable parm::sstmaxd

  static maximum depressional storage; read from .sdr (mm)
- real ∗8, dimension(:), allocatable parm::re

  effective radius of drains (mm)
- real ∗8, dimension(:), allocatable parm::sdrain

  distance between two drain tubes or tiles (mm)
- real ∗8, dimension(:), allocatable **parm::ddrain_hru**
- real ∗8, dimension(:), allocatable parm::drain_co

  drainage coefficient (mm/day)
- real ∗8, dimension(:), allocatable parm::latksatf

  multiplication factor to determine conk(j1,j) from sol_k(j1,j) for HRU (none)
- real ∗8, dimension(:), allocatable parm::pc

  pump capacity (default pump capacity = 1.042mm/hr or 25mm/day) (mm/hr)
- real ∗8, dimension(:), allocatable parm::stmaxd

  maximum surface depressional storage for day in a given HRU (mm)
- real ∗8, dimension(:), allocatable parm::rnd3

  random number between 0.0 and 1.0 (none)
- real ∗8, dimension(:), allocatable parm::rnd2

  random number between 0.0 and 1.0 (none)
- real ∗8, dimension(:), allocatable parm::twash

  time that solids have built-up on streets (days)
- real ∗8, dimension(:), allocatable parm::doxq

  dissolved oxygen concentration in the surface runoff on current day in HRU (mg/L)
- real ∗8, dimension(:), allocatable parm::sol_cnsw

  soil water content used to calculate daily CN value (initial soil water content for day) (mm H2O)
- real ∗8, dimension(:), allocatable parm::rnd8

  random number between 0.0 and 1.0 (none)
- real ∗8, dimension(:), allocatable parm::rnd9

  random number between 0.0 and 1.0 (none)
- real ∗8, dimension(:), allocatable parm::percn

  amount of nitrate percolating past bottom of soil profile during the day (kg N/ha)
- real ∗8, dimension(:), allocatable **parm::sol_sumwp**
- real ∗8, dimension(:), allocatable parm::qdr

  total or net amount of water entering main channel for day from HRU (mm H2O)
- real ∗8, dimension(:), allocatable parm::tauton

  amount of N applied in autofert operation in year (kg N/ha)
- real ∗8, dimension(:), allocatable parm::tautop

  amount of P applied in autofert operation in year (kg N/ha)
- real ∗8, dimension(:), allocatable parm::cbodu

  carbonaceous biological oxygen demand of surface runoff on current day in HRU (mg/L)
- real ∗8, dimension(:), allocatable parm::chl_a

  chlorophyll-a concentration in water yield on current day in HRU (microgram/L)
- real ∗8, dimension(:), allocatable **parm::tfertn**

- real ∗8, dimension(:), allocatable **parm::tfertp**
- real ∗8, dimension(:), allocatable **parm::tgrazn**
- real ∗8, dimension(:), allocatable **parm::tgrazp**
- real ∗8, dimension(:), allocatable parm::latq

  total amount of water in lateral flow in soil profile for the day in HRU (mm H2O)
- real ∗8, dimension(:), allocatable parm::nplnt

  plant uptake of nitrogen in HRU for the day (kg N/ha)
- real ∗8, dimension(:), allocatable parm::latno3

  amount of nitrate transported with lateral flow in HRU for the day (kg N/ha)
- real ∗8, dimension(:), allocatable parm::minpgw

  soluble P loading to reach in groundwater (kg P/ha)
- real ∗8, dimension(:), allocatable parm::no3gw

  nitrate loading to reach in groundwater (kg N/ha)
- real ∗8, dimension(:), allocatable **parm::tileq**
- real ∗8, dimension(:), allocatable **parm::tileno3**
- real ∗8, dimension(:), allocatable parm::sedorgn

  amount of organic nitrogen in surface runoff in HRU for the day (kg N/ha)
- real ∗8, dimension(:), allocatable parm::sedminpa

  amount of active mineral phosphorus sorbed to sediment in surface runoff in HRU for day (kg P/ha)
- real ∗8, dimension(:), allocatable parm::sedminps

  amount of stable mineral phosphorus sorbed to sediment in surface runoff in HRU for day (kg P/ha)
- real ∗8, dimension(:), allocatable parm::sedyld

  soil loss caused by water erosion for day in HRU (metric tons)
- real ∗8, dimension(:), allocatable parm::sepbtm

  percolation from bottom of soil profile for the day in HRU (mm H2O)
- real ∗8, dimension(:), allocatable parm::strsn

  fraction of potential plant growth achieved on the day where the reduction is caused by nitrogen stress (none)
- real ∗8, dimension(:), allocatable parm::sedorgp

  amount of organic phosphorus in surface runoff in HRU for the day (kg P/ha)
- real ∗8, dimension(:), allocatable parm::surfq

  surface runoff generated in HRU on the current day (mm H2O)
- real ∗8, dimension(:), allocatable parm::strstmp

  fraction of potential plant growth achieved on the day in HRU where the reduction is caused by temperature stress (none)
- real ∗8, dimension(:), allocatable parm::strsp

  fraction of potential plant growth achieved on the day where the reduction is caused by phosphorus stress (none)
- real ∗8, dimension(:), allocatable parm::surqno3

  amount of nitrate transported in surface runoff in HRU for the day (kg N/ha)
- real ∗8, dimension(:), allocatable parm::hru_ha

  area of HRU in hectares (ha)
- real ∗8, dimension(:), allocatable parm::hru_dafr

  fraction of total watershed area contained in HRU (km2/km2)
- real ∗8, dimension(:), allocatable **parm::tcfrtn**
- real ∗8, dimension(:), allocatable **parm::tcfrtp**
- real ∗8, dimension(:), allocatable parm::drydep_no3

  atmospheric dry deposition of nitrates (kg/ha/yr)
- real ∗8, dimension(:), allocatable parm::drydep_nh4

  atmospheric dry deposition of ammonia (kg/ha/yr)
- real ∗8, dimension(:), allocatable parm::bio_yrms

  annual biomass (dry weight) in the HRU (metric tons/ha)
- real ∗8, dimension(:), allocatable parm::phubase

base zero total heat units (used when no land cover is growing) (heat units)
- real ∗8, dimension(:), allocatable parm::hvstiadj

  optimal harvest index adjusted for water stress for current time during growing season ((kg/ha)/(kg/ha))
- real ∗8, dimension(:), allocatable parm::laiday

  leaf area index for HRU (m^2/m^2)
- real ∗8, dimension(:), allocatable parm::chlap

  chlorophyll-a production coefficient for pond (none)
- real ∗8, dimension(:), allocatable parm::pnd_psed

  amount of mineral P attached to sediment originating from surface runoff in pond at end of day or beginnig of day (kg P)
- real ∗8, dimension(:), allocatable **parm::laimxfr**
- real ∗8, dimension(:), allocatable parm::seccip

  water clarity coefficient for pond (none)
- real ∗8, dimension(:), allocatable parm::plantn

  amount of nitrogen in plant biomass (kg N/ha)
- real ∗8, dimension(:), allocatable parm::plt_et

  actual ET simulated during life of plant (mm H2O)
- real ∗8, dimension(:), allocatable parm::wet_psed

  amount of mineral P attached to sediment originating from surface runoff in wetland at end of day (kg P)
- real ∗8, dimension(:), allocatable parm::bio_aams

  average annual biomass (dry weight) in the HRU (metric tons)
- real ∗8, dimension(:), allocatable parm::plantp

  amount of phosphorus stored in plant biomass (kg P/ha)
- real ∗8, dimension(:), allocatable parm::plt_pet

  potential ET simulated during life of plant (mm H2O)
- real ∗8, dimension(:), allocatable parm::dormhr

  time threshold used to define dormant period for plant (when daylength is within the time specified by dl from the minimum daylength for the area, the plant will go dormant) (hour)
- real ∗8, dimension(:), allocatable parm::lai_yrmx

  maximum leaf area index for the year in the HRU (none)
- real ∗8, dimension(:), allocatable **parm::bio_aamx**
- real ∗8, dimension(:), allocatable parm::lat_pst

  amount of pesticide in lateral flow in HRU for the day (kg pst/ha)
- real ∗8, dimension(:), allocatable parm::fld_fr

  fraction of HRU area that drains into floodplain (km^2/km^2)
- real ∗8, dimension(:), allocatable **parm::orig_snohru**
- real ∗8, dimension(:), allocatable **parm::orig_potvol**
- real ∗8, dimension(:), allocatable parm::pltfr_n

  fraction of plant biomass that is nitrogen (none)
- real ∗8, dimension(:), allocatable **parm::orig_alai**
- real ∗8, dimension(:), allocatable **parm::orig_bioms**
- real ∗8, dimension(:), allocatable parm::pltfr_p

  fraction of plant biomass that is phosphorus (none)
- real ∗8, dimension(:), allocatable **parm::orig_phuacc**
- real ∗8, dimension(:), allocatable **parm::orig_sumix**
- real ∗8, dimension(:), allocatable parm::phu_plt

  total number of heat units to bring plant to maturity (heat units)
- real ∗8, dimension(:), allocatable **parm::orig_phu**
- real ∗8, dimension(:), allocatable **parm::orig_shallst**
- real ∗8, dimension(:), allocatable **parm::orig_deepst**
- real ∗8, dimension(:), allocatable parm::rip_fr

  fraction of HRU area that drains into riparian zone (km^2/km^2)

- real ∗8, dimension(:), allocatable **parm::orig_pndvol**
- real ∗8, dimension(:), allocatable **parm::orig_pndsed**
- real ∗8, dimension(:), allocatable **parm::orig_pndno3**
- real ∗8, dimension(:), allocatable **parm::orig_pndsolp**
- real ∗8, dimension(:), allocatable **parm::orig_pndorgn**
- real ∗8, dimension(:), allocatable **parm::orig_pndorgp**
- real ∗8, dimension(:), allocatable **parm::orig_wetvol**
- real ∗8, dimension(:), allocatable **parm::orig_wetsed**
- real ∗8, dimension(:), allocatable **parm::orig_wetno3**
- real ∗8, dimension(:), allocatable **parm::orig_wetsolp**
- real ∗8, dimension(:), allocatable **parm::orig_wetorgn**
- real ∗8, dimension(:), allocatable **parm::orig_wetorgp**
- real ∗8, dimension(:), allocatable **parm::orig_solcov**
- real ∗8, dimension(:), allocatable **parm::orig_solsw**
- real ∗8, dimension(:), allocatable **parm::orig_potno3**
- real ∗8, dimension(:), allocatable **parm::orig_potsed**
- real ∗8, dimension(:), allocatable parm::wtab

  water table based on 30 day antecedent climate (precip,et) (mm)
- real ∗8, dimension(:), allocatable **parm::wtab_mn**
- real ∗8, dimension(:), allocatable **parm::wtab_mx**
- real ∗8, dimension(:), allocatable parm::shallst_n

  nitrate concentration in shallow aquifer converted to kg/ha (ppm NO3-N)
- real ∗8, dimension(:), allocatable **parm::gw_nloss**
- real ∗8, dimension(:), allocatable **parm::rchrg_n**
- real ∗8, dimension(:), allocatable **parm::det_san**
- real ∗8, dimension(:), allocatable **parm::det_sil**
- real ∗8, dimension(:), allocatable **parm::det_cla**
- real ∗8, dimension(:), allocatable **parm::det_sag**
- real ∗8, dimension(:), allocatable **parm::det_lag**
- real ∗8, dimension(:), allocatable parm::afrt_surface

  fraction of fertilizer which is applied to top 10 mm of soil (the remaining fraction is applied to first soil layer) (none)
- real ∗8, dimension(:), allocatable parm::tnylda

  estimated/target nitrogen content of yield used in autofertilization (kg N/kg yield)
- real ∗8 parm::frt_surface

  fraction of fertilizer which is applied to the top 10 mm of soil (the remaining fraction is applied to the first soil layer) (none)
- real ∗8, dimension(:), allocatable parm::auto_nyr

  maximum NO3-N content allowed to be applied in one year by auto-fertilization (kg NO3-N/ha)
- real ∗8, dimension(:), allocatable parm::auto_napp

  maximum NO3-N content allowed in one fertilizer application (kg NO3-N/ha)
- real ∗8, dimension(:), allocatable parm::auto_nstrs

  nitrogen stress factor which triggers auto fertilization (none)
- real ∗8, dimension(:), allocatable parm::manure_kg

  dry weight of manure deposited on HRU daily ((kg/ha)/day)
- real ∗8, dimension(:,:), allocatable **parm::rcn_mo**
- real ∗8, dimension(:,:), allocatable **parm::rammo_mo**
- real ∗8, dimension(:,:), allocatable **parm::drydep_no3_mo**
- real ∗8, dimension(:,:), allocatable **parm::drydep_nh4_mo**
- real ∗8, dimension(:), allocatable **parm::rcn_d**
- real ∗8, dimension(:), allocatable **parm::rammo_d**
- real ∗8, dimension(:), allocatable **parm::drydep_no3_d**
- real ∗8, dimension(:), allocatable **parm::drydep_nh4_d**
- real ∗8, dimension(:,:), allocatable **parm::yldn**

- integer, dimension(:,:), allocatable **parm::gwati**
- real ∗8, dimension(:,:), allocatable **parm::gwatn**
- real ∗8, dimension(:,:), allocatable **parm::gwatl**
- real ∗8, dimension(:,:), allocatable **parm::gwatw**
- real ∗8, dimension(:,:), allocatable **parm::gwatd**
- real ∗8, dimension(:,:), allocatable **parm::gwatveg**
- real ∗8, dimension(:,:), allocatable **parm::gwata**
- real ∗8, dimension(:,:), allocatable **parm::gwats**
- real ∗8, dimension(:,:), allocatable **parm::gwatspcon**
- real ∗8, dimension(:,:), allocatable **parm::rfqeo_30d**
- real ∗8, dimension(:,:), allocatable **parm::eo_30d**
- real ∗8, dimension(:,:), allocatable parm::psetlp

  psetlp(1,:) phosphorus settling rate for 1st season (m/day)
  psetlp(2,:) phosphorus settling rate for 2nd season (m/day)
- real ∗8, dimension(:,:), allocatable parm::wgnold

  previous value of wgncur(:,:) (none)
- real ∗8, dimension(:,:), allocatable parm::wgncur

  parameter to predict the impact of precip on other weather attributes (none)
  wgncur(1,:) parameter which predicts impact of precip on daily maximum air temperature
  wgncur(2,:) parameter which predicts impact of precip on daily minimum air temperature
  wgncur(3,:) parameter which predicts impact of precip on daily solar radiation
- real ∗8, dimension(:), allocatable parm::wrt1

  1st shape parameter for calculation of water retention (none)
- real ∗8, dimension(:), allocatable parm::wrt2

  2nd shape parameter for calculation of water retention (none)
- real ∗8, dimension(:,:), allocatable parm::pst_enr

  pesticide enrichment ratio (none)
- real ∗8, dimension(:,:), allocatable parm::pst_surq

  amount of pesticide type lost in surface runoff on current day in HRU (kg/ha)
- real ∗8, dimension(:,:), allocatable parm::zdb

  division term from net pesticide equation (mm)
- real ∗8, dimension(:,:), allocatable parm::plt_pst

  pesticide on plant foliage (kg/ha)
- real ∗8, dimension(:,:), allocatable parm::psetlw

  psetlw(1,:) phosphorus settling rate for 1st season (m/day)
  psetlw(2,:) phosphorus settling rate for 2nd season (m/day)
- real ∗8, dimension(:,:), allocatable parm::pst_sed

  pesticide loading from HRU sorbed onto sediment (kg/ha)
- real ∗8, dimension(:,:), allocatable parm::wupnd

  average daily water removal from the pond for the month for the HRU within the subbasin (10^4 m^3/day)
- real ∗8, dimension(:,:), allocatable parm::phi

  phi(1,:) cross-sectional area of flow at bankfull depth (m^2) phi(2,:) (none) phi(3,:) (none) phi(4,:) (none) phi(5,:) flow rate when reach is at bankfull depth (m^3/s) phi(6,:) bottom width of main channel (m) phi(7,:) depth of water when reach is at bankfull depth (m) phi(8,:) average velocity when reach is at bankfull depth (m/s) phi(9,:) wave celerity when reach is at bankfull depth (m/s) phi(10,:) storage time constant for reach at bankfull depth (ratio of storage to discharge) (hour) phi(11,:) average velocity when reach is at 0.1 bankfull depth (low flow) (m/s) phi(12,:) wave celerity when reach is at 0.1 bankfull depth (low flow) (m/s) phi(13,:) storage time constant for reach at 0.1 bankfull depth (low flow) (ratio of storage to discharge) (hour)
- real ∗8, dimension(:,:), allocatable parm::pcpband

  precipitation for the day in band in HRU (mm H2O)
- real ∗8, dimension(:,:), allocatable parm::tavband

  average temperature for the day in band in HRU (deg C)
- real ∗8, dimension(:), allocatable parm::wat_phi1

  cross-sectional area of flow at bankfull depth (m^2)

- real ∗8, dimension(:), allocatable parm::wat_phi5

  flow rate when reach is at bankfull depth (m^ 3/s)
- real ∗8, dimension(:), allocatable parm::wat_phi6

  bottom width of main channel (m)
- real ∗8, dimension(:), allocatable parm::wat_phi7

  depth of water when reach is at bankfull depth (m)
- real ∗8, dimension(:), allocatable parm::wat_phi8

  average velocity when reach is at bankfull depth (m/s)
- real ∗8, dimension(:), allocatable parm::wat_phi9

  wave celerity when reach is at bankfull depth (m/s)
- real ∗8, dimension(:), allocatable parm::wat_phi10

  storage time constant for reach at bankfull depth (ratio of storage to discharge) (hour)
- real ∗8, dimension(:), allocatable parm::wat_phi11

  average velocity when reach is at 0.1 bankfull depth (low flow) (m/s)
- real ∗8, dimension(:), allocatable parm::wat_phi12

  wave celerity when reach is at 0.1 bankfull depth (low flow) (m/s)
- real ∗8, dimension(:), allocatable parm::wat_phi13

  storage time constant for reach at 0.1 bankfull depth (low flow) (ratio of storage to discharge) (hour)
- real ∗8, dimension(:,:), allocatable parm::snoeb

  snow water content in elevation band on current day (mm H2O)
- real ∗8, dimension(:,:), allocatable parm::wudeep

  average daily water removal from the deep aquifer for the month for the HRU within the subbasin (10^ 4 m^ 3/day)
- real ∗8, dimension(:,:), allocatable parm::wushal

  average daily water removal from the shallow aquifer for the month for the HRU within the subbasin (10^ 4 m^ 3/day)
- real ∗8, dimension(:,:), allocatable parm::tmnband

  minimum temperature for the day in band in HRU (deg C)
- real ∗8, dimension(:,:), allocatable parm::bss

  bss(1,:) amount of lateral flow lagged (mm H2O)
  bss(2,:) amount of nitrate in lateral flow lagged (kg N/ha)
  bss(3,:) amount of tile flow lagged (mm)
  bss(4,:) amount of nitrate in tile flow lagged (kg N/ha)
- real ∗8, dimension(:,:), allocatable parm::nsetlw

  nsetlw(1,:) nitrogen settling rate for 1st season (m/day)
  nsetlw(2,:) nitrogen settling rate for 2nd season (m/day)
- real ∗8, dimension(:,:), allocatable parm::snotmpeb

  temperature of snow pack in elevation band (deg C)
- real ∗8, dimension(:,:), allocatable parm::surf_bs

  surf_bs(1,:) amount of surface runoff lagged over one day (mm H2O)
  surf_bs(2,:) amount of sediment yield lagged over one day (metric tons)
  surf_bs(3,:) amount of organic nitrogen loading lagged over one day (kg N/ha)
  surf_bs(4,:) amount of organic phosphorus loading lagged over one day (kg P/ha)
  surf_bs(5,:) amount of nitrate loading in surface runoff lagged over one day (kg N/ha)
  surf_bs(6,:) amount of soluble phosphorus loading lagged over one day (kg P/ha)
  surf_bs(7,:) amount of active mineral phosphorus loading lagged over one day (kg P/ha)
  surf_bs(8,:) amount of stable mineral phosphorus loading lagged over one day (kg P/ha)
  surf_bs(9,:) amount of less persistent bacteria in solution lagged over one day (# colonies/ha)
  surf_bs(10,:) amount of persistent bacteria in solution lagged over one day (# colonies/ha)
  surf_bs(11,:) amount of less persistent bacteria sorbed lagged over one day (# colonies/ha)
  surf_bs(12,:) amount of persistent bacteria sorbed lagged over one day (# colonies/ha)
- real ∗8, dimension(:,:), allocatable parm::nsetlp

  nsetlp(1,:) nitrogen settling rate for 1st season (m/day)
  nsetlp(2,:) nitrogen settling rate for 2nd season (m/day)
- real ∗8, dimension(:,:), allocatable parm::tmxband

  maximum temperature for the day in band in HRU (deg C)

- real ∗8, dimension(:,:), allocatable parm::frad

  fraction of solar radiation occuring during hour in day in HRU (none)
- real ∗8, dimension(:,:), allocatable parm::rainsub

  precipitation for the time step during the day in HRU (mm H2O)
- real ∗8, dimension(:), allocatable **parm::rstpbsb**
- real ∗8, dimension(:,:), allocatable **parm::orig_snoeb**
- real ∗8, dimension(:,:), allocatable **parm::orig_pltpst**
- real ∗8, dimension(:,:), allocatable **parm::terr_p**
- real ∗8, dimension(:,:), allocatable **parm::terr_cn**
- real ∗8, dimension(:,:), allocatable **parm::terr_sl**
- real ∗8, dimension(:,:), allocatable **parm::drain_d**
- real ∗8, dimension(:,:), allocatable **parm::drain_t**
- real ∗8, dimension(:,:), allocatable **parm::drain_g**
- real ∗8, dimension(:,:), allocatable **parm::drain_idep**
- real ∗8, dimension(:,:), allocatable **parm::cont_cn**
- real ∗8, dimension(:,:), allocatable **parm::cont_p**
- real ∗8, dimension(:,:), allocatable **parm::filt_w**
- real ∗8, dimension(:,:), allocatable **parm::strip_n**
- real ∗8, dimension(:,:), allocatable **parm::strip_cn**
- real ∗8, dimension(:,:), allocatable **parm::strip_c**
- real ∗8, dimension(:,:), allocatable **parm::strip_p**
- real ∗8, dimension(:,:), allocatable **parm::fire_cn**
- real ∗8, dimension(:,:), allocatable **parm::cropno_upd**
- real ∗8, dimension(:,:), allocatable **parm::hi_upd**
- real ∗8, dimension(:,:), allocatable **parm::laimx_upd**
- real ∗8, dimension(:,:,:), allocatable parm::phug

  fraction of plant heat units at which grazing begins (none)
- real ∗8, dimension(:,:,:), allocatable parm::pst_lag

  pst_lag(1,:,:) amount of soluble pesticide in surface runoff lagged (kg pst/ha)
  pst_lag(2,:,:) amount of sorbed pesticide in surface runoff lagged (kg pst/ha)
  pst_lag(3,:,:) amount of pesticide lagged (kg pst/ha)
- integer, dimension(:), allocatable parm::hrupest

  pesticide use flag (none)
  0: no pesticides used in HRU
  1: pesticides used in HRU
- integer, dimension(:), allocatable parm::nrelease

  sequence number of impound/release operation within the year (none)
- integer, dimension(:), allocatable parm::swtrg

  rainfall event flag (none):
  0: no rainfall event over midnight
  1: rainfall event over midnight
- integer, dimension(:), allocatable parm::nrot

  number of years of rotation (none)
- integer, dimension(:), allocatable parm::nfert

  sequence number of fertilizer application within the year (none)
- integer, dimension(:), allocatable parm::nro

  sequence number of year in rotation (none)
- integer, dimension(:), allocatable parm::igro

  land cover status code (none). This code informs the model whether or not a land cover is growing at the beginning of the simulation
  0 no land cover currently growing
  1 land cover growing
- integer, dimension(:,:), allocatable parm::ipnd

ipnd(1,:) beginning month of 2nd "season" of nutrient settling season (none)
ipnd(2,:) ending month of 2nd "season" of nutrient settling season (none)

- integer, dimension(:), allocatable parm::nair

  sequence number of auto-irrigation application within the year (none)
- integer, dimension(:,:), allocatable parm::iflod

  iflod(1,:) beginning month of non-flood season (none)
  iflod(2,:) ending month of non-flood season (none)
- integer, dimension(:), allocatable parm::ndtarg

  number of days required to reach target storage from current pond storage (none)
- integer, dimension(:), allocatable parm::nirr

  sequence number of irrigation application within the year (none)
- integer, dimension(:), allocatable parm::nstress

  code for approach used to determine amount of nitrogen to HRU (none):
  0 nitrogen target approach
  1 annual max approach
- integer, dimension(:), allocatable **parm::iafrttyp**
- integer, dimension(:), allocatable **parm::igrotree**
- integer, dimension(:), allocatable parm::grz_days

  number of days grazing will be simulated (none)
- integer, dimension(:), allocatable parm::nmgt

  management code (for GIS output only) (none)
- integer, dimension(:), allocatable parm::nafert

  sequence number of auto-fert application within the year (none)
- integer, dimension(:), allocatable parm::nsweep

  sequence number of street sweeping operation within the year (none)
- integer, dimension(:), allocatable parm::icr

  sequence number of crop grown within the current year (none)
- integer, dimension(:), allocatable parm::ncut

  sequence number of harvest operation within a year (none)
- integer, dimension(:), allocatable parm::irrno

  irrigation source location (none)
  if IRRSC=1, IRRNO is the number of the reach
  if IRRSC=2, IRRNO is the number of the reservoir
  if IRRSC=3, IRRNO is the number of the subbasin
  if IRRSC=4, IRRNO is the number of the subbasin
  if IRRSC=5, not used
- integer, dimension(:), allocatable parm::sol_nly

  number of soil layers in HRU (none)
- integer, dimension(:), allocatable parm::npcp

  prior day category (none)
  1 dry day
  2 wet day
- integer, dimension(:), allocatable parm::irn

  average annual number of irrigation applications in HRU (none)
- integer, dimension(:), allocatable parm::ncf

  sequence number of continuous fertilization operation within the year (none)
- integer, dimension(:), allocatable parm::ngr

  sequence number of grazing operation within the year (none)
- integer, dimension(:), allocatable parm::igrz

  grazing flag for HRU (none):
  0 HRU currently not grazed
  1 HRU currently grazed
- integer, dimension(:), allocatable parm::ndeat

number of days HRU has been grazed (days)

- integer, dimension(:), allocatable parm::hru_sub

  subbasin number in which HRU/reach is located (none)
- integer, dimension(:), allocatable parm::urblu

  urban land type identification number from urban database (urban.dat) (none)
- integer, dimension(:), allocatable parm::ldrain

  soil layer where drainage tile is located (none)
- integer, dimension(:), allocatable parm::idorm

  dormancy status code (none):
  0 land cover growing (not dormant)
  1 land cover dormant
- integer, dimension(:), allocatable **parm::hru_seq**
- integer, dimension(:), allocatable parm::iurban

  urban simulation code (none):
  0 no urban sections in HRU
  1 urban sections in HRU, simulate using USGS regression equations
  2 urban sections in HRU, simulate using build up/wash off algorithm
- integer, dimension(:), allocatable parm::icfrt

  continuous fertilizer flag for HRU (none):
  0 HRU currently not continuously fertilized
  1 HRU currently continuously fertilized
- integer, dimension(:), allocatable **parm::iday_fert**
- integer, dimension(:), allocatable parm::ifld

  number of HRU (in subbasin) that is a floodplain (none)
- integer, dimension(:), allocatable parm::irip

  number of HRU (in subbasin) that is a riparian zone (none)
- integer, dimension(:), allocatable parm::hrugis

  GIS code printed to output files (output.hru, output.rch) (none)
- integer, dimension(:), allocatable parm::ndcfrt

  number of days HRU has been continuously fertilized (days)
- integer, dimension(:), allocatable parm::irrsc

  irrigation source code (none):
  1 divert water from reach
  2 divert water from reservoir
  3 divert water from shallow aquifer
  4 divert water from deep aquifer
  5 divert water from source outside watershed
- integer, dimension(:), allocatable parm::ntil

  sequence number of tillage operation within current year (none)
- integer, dimension(:), allocatable **parm::orig_igro**
- integer, dimension(:), allocatable parm::iwatable

  high water table code (none):
  0 no high water table
  1 high water table
- integer, dimension(:), allocatable **parm::curyr_mat**
- integer, dimension(:), allocatable parm::icpst

  icpst = 0 do not apply
  icpst = 1 application period
- integer, dimension(:), allocatable parm::ndcpst

  current day within the application period (day)
- integer, dimension(:), allocatable **parm::ncpest**
- integer, dimension(:), allocatable parm::iday_pest

  current day between applications (day)
- integer, dimension(:), allocatable **parm::irr_flag**

- integer, dimension(:), allocatable **parm::irra_flag**
- integer, dimension(:,:), allocatable parm::rndseed

    random number generator seeds array. The seeds in the array are used to generate random numbers for the following purposes (none):
    (1) wet/dry day probability
    (2) solar radiation
    (3) precipitation
    (4) USLE rainfall erosion index
    (5) wind speed
    (6) 0.5 hr rainfall fraction
    (7) relative humidity
    (8) maximum temperature
    (9) minimum temperature
    (10) generate new random numbers
- integer, dimension(:,:), allocatable **parm::iterr**
- integer, dimension(:,:), allocatable **parm::iyterr**
- integer, dimension(:,:), allocatable **parm::itdrain**
- integer, dimension(:,:), allocatable **parm::iydrain**
- integer, dimension(:,:), allocatable **parm::ncrops**
- integer, dimension(:), allocatable parm::manure_id

    manure (fertilizer) identification number from fert.dat (none)
- integer, dimension(:,:), allocatable **parm::mgt_sdr**
- integer, dimension(:,:), allocatable **parm::idplrot**
- integer, dimension(:,:), allocatable **parm::icont**
- integer, dimension(:,:), allocatable **parm::iycont**
- integer, dimension(:,:), allocatable **parm::ifilt**
- integer, dimension(:,:), allocatable **parm::iyfilt**
- integer, dimension(:,:), allocatable **parm::istrip**
- integer, dimension(:,:), allocatable **parm::iystrip**
- integer, dimension(:,:), allocatable **parm::iopday**
- integer, dimension(:,:), allocatable **parm::iopyr**
- integer, dimension(:,:), allocatable **parm::mgt_ops**
- real ∗8, dimension(:), allocatable parm::wshd_pstap

    total amount of pesticide type applied in watershed during simulation (kg/ha)
- real ∗8, dimension(:), allocatable parm::wshd_pstdg

    amount of pesticide lost through degradation in watershed (kg pst/ha)
- integer, dimension(12) **parm::ndmo**
- integer, dimension(:), allocatable parm::npno

    array of unique pesticides used in watershed (none)
- integer, dimension(:), allocatable **parm::mcrhru**
- character(len=13), dimension(18) parm::rfile

    rainfall file names (.pcp)
- character(len=13), dimension(18) parm::tfile

    temperature file names (.tmp)
- character(len=4), dimension(1000) parm::urbname

    name of urban land use
- character(len=1), dimension(:), allocatable parm::kirr

    irrigation in HRU
- character(len=1), dimension(:), allocatable **parm::hydgrp**
- character(len=16), dimension(:), allocatable parm::snam

    soil series name
- character(len=17), dimension(300) parm::pname

    name of pesticide/toxin
- character(len=4), dimension(60) parm::title

description lines in file.cio (1st 3 lines)

- character(len=4), dimension(5000) parm::cpnm

  four character code to represent crop name
- character(len=17), dimension(50) **parm::fname**
- real ∗8, dimension(:,:,:), allocatable parm::flomon

  average daily water loading for month (m^ 3/day)
- real ∗8, dimension(:,:,:), allocatable parm::solpstmon

  average daily soluble pesticide loading for month (mg pst/day)
- real ∗8, dimension(:,:,:), allocatable parm::srbpstmon

  average daily sorbed pesticide loading for month (mg pst/day)
- real ∗8, dimension(:,:,:), allocatable parm::orgnmon

  average daily organic N loading for month (kg N/day)
- real ∗8, dimension(:,:,:), allocatable parm::orgpmon

  average daily organic P loading for month (kg P/day)
- real ∗8, dimension(:,:,:), allocatable parm::sedmon

  average daily sediment loading for month (metric tons/day)
- real ∗8, dimension(:,:,:), allocatable parm::minpmon

  average daily mineral P loading for month (kg P/day)
- real ∗8, dimension(:,:,:), allocatable parm::nh3mon

  average amount of NH3-N loaded to stream on a given day in the month (kg N/day)
- real ∗8, dimension(:,:,:), allocatable parm::no3mon

  average daily NO3-N loading for month (kg N/day)
- real ∗8, dimension(:,:,:), allocatable parm::bactlpmon

  average amount of less persistent bacteria loaded to stream on a given day in the month (# bact/day)
- real ∗8, dimension(:,:,:), allocatable parm::bactpmon

  average amount of persistent bacteria loaded to stream on a given day in the month (# bact/day)
- real ∗8, dimension(:,:,:), allocatable parm::no2mon

  average amount of NO2-N loaded to stream on a given day in the month (kg N/day)
- real ∗8, dimension(:,:,:), allocatable parm::cmtl1mon

  average amount of conservative metal #1 loaded to stream on a given day in the month (# bact/day)
- real ∗8, dimension(:,:,:), allocatable parm::cmtl2mon

  average amount of conservative metal #2 loaded to stream on a given day in the month (# bact/day)
- real ∗8, dimension(:,:,:), allocatable parm::cmtl3mon

  average amount of conservative metal #3 loaded to stream on a given day in the month (# bact/day)
- real ∗8, dimension(:,:,:), allocatable parm::cbodmon

  average daily loading of CBOD in month (kg/day)
- real ∗8, dimension(:,:,:), allocatable parm::chlamon

  average daily loading of chlorophyll-a in month (kg/day)
- real ∗8, dimension(:,:,:), allocatable parm::disoxmon

  average daily loading of dissolved O2 in month (kg/day)
- real ∗8, dimension(:,:), allocatable parm::floyr

  average daily water loading for year (m^ 3/day)
- real ∗8, dimension(:,:), allocatable parm::orgnyr

  average daily organic N loading for year (kg N/day)
- real ∗8, dimension(:,:), allocatable parm::orgpyr

  average daily organic P loading for year (kg P/day)
- real ∗8, dimension(:,:), allocatable parm::sedyr

  average daily sediment loading for year (metric tons/day)
- real ∗8, dimension(:,:), allocatable parm::minpyr

  average daily mineral P loading for year (kg P/day)
- real ∗8, dimension(:,:), allocatable parm::nh3yr

average daily NH3-N loading for year (kg N/day)
- real ∗8, dimension(:,:), allocatable parm::no2yr

  average daily NO2-N loading for year (kg N/day)
- real ∗8, dimension(:,:), allocatable parm::no3yr

  average daily NO3-N loading for year (kg N/day)
- real ∗8, dimension(:,:), allocatable parm::bactlpyr

  average daily loading of less persistent bacteria for year (# bact/day)
- real ∗8, dimension(:,:), allocatable parm::bactpyr

  average daily loading of persistent bacteria for year (# bact/day)
- real ∗8, dimension(:,:), allocatable parm::cmtl1yr

  average daily loading of conservative metal #1 for year (kg/day)
- real ∗8, dimension(:,:), allocatable parm::chlayr

  average daily loading of chlorophyll-a in year (kg/day)
- real ∗8, dimension(:,:), allocatable parm::cmtl2yr

  average daily loading of conservative metal #2 for year (kg/day)
- real ∗8, dimension(:,:), allocatable parm::cmtl3yr

  average daily loading of conservative metal #3 for year (kg/day)
- real ∗8, dimension(:,:), allocatable parm::cbodyr

  average daily loading of CBOD in year (kg/day)
- real ∗8, dimension(:,:), allocatable parm::disoxyr

  average daily loading of dissolved O2 in year (kg/day)
- real ∗8, dimension(:,:), allocatable parm::solpstyr

  average daily soluble pesticide loading for year (mg pst/day)
- real ∗8, dimension(:,:), allocatable parm::srbpstyr

  average daily sorbed pesticide loading for year (mg pst/day)
- real ∗8, dimension(:,:), allocatable **parm::sol_mc**
- real ∗8, dimension(:,:), allocatable **parm::sol_mn**
- real ∗8, dimension(:,:), allocatable **parm::sol_mp**
- real ∗8, dimension(:), allocatable **parm::flocnst**
- real ∗8, dimension(:), allocatable parm::orgncnst

  average daily organic N loading to reach (kg N/day)
- real ∗8, dimension(:), allocatable parm::sedcnst

  average daily sediment loading for reach (metric tons/day)
- real ∗8, dimension(:), allocatable parm::minpcnst

  average daily soluble P loading to reach (kg P/day)
- real ∗8, dimension(:), allocatable parm::no3cnst

  average daily nitrate loading to reach (kg N/day)
- real ∗8, dimension(:), allocatable parm::orgpcnst

  average daily organic P loading to reach (kg P/day)
- real ∗8, dimension(:), allocatable parm::bactpcnst

  average daily persistent bacteria loading to reach (# bact/day)
- real ∗8, dimension(:), allocatable parm::nh3cnst

  average daily ammonia loading to reach (kg N/day)
- real ∗8, dimension(:), allocatable parm::no2cnst

  average daily nitrite loading to reach (kg N/day)
- real ∗8, dimension(:), allocatable parm::bactlpcnst

  average daily less persistent bacteria loading to reach (# bact/day)
- real ∗8, dimension(:), allocatable parm::cmtl1cnst

  average daily conservative metal #1 loading (kg/day)
- real ∗8, dimension(:), allocatable parm::cmtl2cnst

  average daily conservative metal #2 loading (kg/day)

- real ∗8, dimension(:), allocatable parm::chlacnst

  average daily loading of chlorophyll-a (kg/day)
- real ∗8, dimension(:), allocatable parm::cmtl3cnst

  average daily conservative metal #3 loading (kg/day)
- real ∗8, dimension(:), allocatable parm::disoxcnst

  average daily loading of dissolved O2 (kg/day)
- real ∗8, dimension(:), allocatable parm::cbodcnst

  average daily loading of CBOD to reach (kg/day)
- real ∗8, dimension(:), allocatable parm::solpstcnst

  average daily soluble pesticide loading (mg/day)
- real ∗8, dimension(:), allocatable parm::srbpstcnst

  average daily sorbed pesticide loading (mg/day)
- integer parm::nstep

  max number of time steps per day or number of lines of rainfall data for each day (depends on model operational time step) (none)
- integer parm::idt

  length of time step used to report precipitation data for sub-daily modeling (operational time step) (minutes)
- real ∗8, dimension(:), allocatable parm::hdepth

  depth of flow during hour (m)
- real ∗8, dimension(:), allocatable parm::hhstor

  water stored in reach at end of hour (m^3 H2O)
- real ∗8, dimension(:), allocatable parm::hrtwtr

  water leaving reach in hour (m^3)
- real ∗8, dimension(:), allocatable parm::hsdti

  flow rate in reach for hour (m^3/s)
- real ∗8, dimension(:), allocatable parm::hrchwtr

  water stored in reach at beginning of hour (m^3 H2O)
- real ∗8, dimension(:), allocatable parm::hnh4

  ammonia concentration in reach at end of hour (mg N/L)
- real ∗8, dimension(:), allocatable parm::horgn

  organic nitrogen concentration in reach at end of hour (mg N/L)
- real ∗8, dimension(:), allocatable **parm::halgae**
- real ∗8, dimension(:), allocatable parm::hbod

  carbonaceous biochemical oxygen demand in reach at end of hour (mg O2/L)
- real ∗8, dimension(:), allocatable parm::hno2

  nitrite concentration in reach at end of hour (mg N/L)
- real ∗8, dimension(:), allocatable parm::hno3

  nitrate concentration in reach at end of hour (mg N/L)
- real ∗8, dimension(:), allocatable parm::horgp

  organic phosphorus concentration in reach at end of hour (mg P/L)
- real ∗8, dimension(:), allocatable parm::hsolp

  dissolved phosphorus concentration in reach at end of hour (mg P/L)
- real ∗8, dimension(:), allocatable parm::hchla

  chlorophyll-a concentration in reach at end of hour (mg chl-a/L)
- real ∗8, dimension(:), allocatable parm::hdisox

  dissolved oxygen concentration in reach at end of hour (mg O2/L)
- real ∗8, dimension(:), allocatable parm::hsedyld

  sediment transported out of reach during hour (metric tons)
- real ∗8, dimension(:), allocatable **parm::hsedst**
- real ∗8, dimension(:), allocatable parm::hharea

  cross-sectional area of flow (m^2)

- real ∗8, dimension(:), allocatable parm::hsolpst

    soluble pesticide concentration in outflow on day (mg pst/m^3)
- real ∗8, dimension(:), allocatable parm::hsorpst

    sorbed pesticide concentration in outflow on day (mg pst/m^3)
- real ∗8, dimension(:), allocatable parm::hhqday

    surface runoff generated each timestep of day in HRU (mm H2O)
- real ∗8, dimension(:), allocatable parm::precipdt

    precipitation, or effective precipitation reaching soil surface, in time step for HRU (mm H2O)
- real ∗8, dimension(:), allocatable parm::hhtime

    travel time of flow in reach for hour (hour)
- real ∗8, dimension(:), allocatable parm::hbactlp

    less persistent bacteria in reach/outflow during hour (# cfu/100mL)
- real ∗8, dimension(:), allocatable parm::hbactp

    persistent bacteria in reach/outflow during hour (# cfu/100mL)
- integer, dimension(10) **parm::ivar_orig**
- real ∗8, dimension(10) **parm::rvar_orig**
- integer parm::nsave

    number of save commands in .fig file
- integer **parm::nauto**
- integer **parm::iatmodep**
- real ∗8, dimension(:), allocatable **parm::wattemp**
- real ∗8, dimension(:), allocatable **parm::lkpst_mass**
- real ∗8, dimension(:), allocatable **parm::lkspst_mass**
- real ∗8, dimension(:), allocatable **parm::vel_chan**
- real ∗8, dimension(:), allocatable parm::vfscon

    fraction of the total runoff from the entire field entering the most concentrated 10% of the VFS (none)
- real ∗8, dimension(:), allocatable parm::vfsratio

    field area/VFS area ratio (none)
- real ∗8, dimension(:), allocatable parm::vfsch

    fraction of flow entering the most concentrated 10% of the VFS which is fully channelized (none)
- real ∗8, dimension(:), allocatable **parm::vfsi**
- real ∗8, dimension(:,:), allocatable **parm::filter_i**
- real ∗8, dimension(:,:), allocatable **parm::filter_ratio**
- real ∗8, dimension(:,:), allocatable **parm::filter_con**
- real ∗8, dimension(:,:), allocatable **parm::filter_ch**
- real ∗8, dimension(:,:), allocatable **parm::sol_n**
- integer parm::cswat

    = 0 Static soil carbon (old mineralization routines)
    = 1 C-FARM one carbon pool model
    = 2 Century model
- real ∗8, dimension(:,:), allocatable **parm::sol_bdp**
- real ∗8, dimension(:,:), allocatable **parm::tillagef**
- real ∗8, dimension(:), allocatable **parm::rtfr**
- real ∗8, dimension(:), allocatable parm::stsol_rd

    storing last soil root depth for use in harvestkillop/killop (mm)
- integer **parm::urban_flag**
- integer **parm::dorm_flag**
- real ∗8 **parm::bf_flg**
- real ∗8 **parm::iabstr**
- real ∗8, dimension(:), allocatable parm::ubntss

    TSS loading from urban impervious cover (metric tons)
- real ∗8, dimension(:), allocatable parm::ubnrunoff

surface runoff from urban impervious cover (mm H2O)

- real ∗8, dimension(:,:), allocatable parm::sub_ubnrunoff

  surface runoff from urban impervious cover in subbasin (mm H2O)
- real ∗8, dimension(:,:), allocatable parm::sub_ubntss

  TSS loading from urban impervious cover in subbasin (metric tons)
- real ∗8, dimension(:,:), allocatable **parm::ovrlnd_dt**
- real ∗8, dimension(:,:,:), allocatable **parm::hhsurf_bs**
- integer parm::iuh

  unit hydrograph method: 1=triangular UH; 2=gamma funtion UH;
- integer parm::sed_ch

  channel routing for HOURLY; 0=Bagnold; 2=Brownlie; 3=Yang;
- real ∗8 parm::eros_expo

  an exponent in the overland flow erosion equation ranges 1.5-3.0
- real ∗8 parm::eros_spl

  coefficient of splash erosion varing 0.9-3.1
- real ∗8 parm::rill_mult

  Multiplier to USLE_K for soil susceptible to rill erosion, range 0.5-2.0.
- real ∗8 **parm::sedprev**
- real ∗8 **parm::c_factor**
- real ∗8 parm::ch_d50

  median particle diameter of channel bed (mm)
- real ∗8 parm::sig_g

  geometric standard deviation of particle sizes for the main channel. Mean air temperature at which precipitation is equally likely to be rain as snow/freezing rain.
- real ∗8 parm::uhalpha

  alpha coefficient for estimating unit hydrograph using a gamma function (∗.bsn)
- real ∗8 **parm::abstinit**
- real ∗8 **parm::abstmax**
- real ∗8, dimension(:,:), allocatable parm::hhsedy

  sediment yield from HRU drung a time step applied to HRU (tons)
- real ∗8, dimension(:,:), allocatable parm::sub_subp_dt

  precipitation for time step in subbasin (mm H2O)
- real ∗8, dimension(:,:), allocatable parm::sub_hhsedy

  sediment yield for the time step in subbasin (metric tons)
- real ∗8, dimension(:,:), allocatable **parm::sub_atmp**
- real ∗8, dimension(:), allocatable parm::rhy

  main channel hydraulic radius (m H2O)
- real ∗8, dimension(:), allocatable **parm::init_abstrc**
- real ∗8, dimension(:), allocatable parm::hrtevp

  evaporation losses for hour (m^3 H2O)
- real ∗8, dimension(:), allocatable parm::hrttlc

  transmission losses for hour (m^3 H2O)
- real ∗8, dimension(:), allocatable **parm::dratio**
- real ∗8, dimension(:,:,:), allocatable **parm::rchhr**
- real ∗8, dimension(:), allocatable **parm::hhresflwi**
- real ∗8, dimension(:), allocatable **parm::hhresflwo**
- real ∗8, dimension(:), allocatable **parm::hhressedi**
- real ∗8, dimension(:), allocatable **parm::hhressedo**
- character(len=4), dimension(:), allocatable **parm::lu_nodrain**
- integer, dimension(:), allocatable **parm::bmpdrain**
- real ∗8, dimension(:), allocatable **parm::sub_cn2**
- real ∗8, dimension(:), allocatable **parm::sub_ha_urb**

- real ∗8, dimension(:), allocatable **parm::bmp_recharge**
- real ∗8, dimension(:), allocatable **parm::sub_ha_imp**
- real ∗8, dimension(:), allocatable **parm::subdr_km**
- real ∗8, dimension(:), allocatable **parm::subdr_ickm**
- real ∗8, dimension(:,:), allocatable **parm::sf_im**
- real ∗8, dimension(:,:), allocatable **parm::sf_iy**
- real ∗8, dimension(:,:), allocatable **parm::sp_sa**
- real ∗8, dimension(:,:), allocatable **parm::sp_pvol**
- real ∗8, dimension(:,:), allocatable **parm::sp_pd**
- real ∗8, dimension(:,:), allocatable **parm::sp_sedi**
- real ∗8, dimension(:,:), allocatable **parm::sp_sede**
- real ∗8, dimension(:,:), allocatable **parm::ft_sa**
- real ∗8, dimension(:,:), allocatable **parm::ft_fsa**
- real ∗8, dimension(:,:), allocatable **parm::ft_dep**
- real ∗8, dimension(:,:), allocatable **parm::ft_h**
- real ∗8, dimension(:,:), allocatable **parm::ft_pd**
- real ∗8, dimension(:,:), allocatable **parm::ft_k**
- real ∗8, dimension(:,:), allocatable **parm::ft_dp**
- real ∗8, dimension(:,:), allocatable **parm::ft_dc**
- real ∗8, dimension(:,:), allocatable **parm::ft_por**
- real ∗8, dimension(:,:), allocatable **parm::tss_den**
- real ∗8, dimension(:,:), allocatable **parm::ft_alp**
- real ∗8, dimension(:,:), allocatable **parm::sf_fr**
- real ∗8, dimension(:,:), allocatable **parm::sp_qi**
- real ∗8, dimension(:,:), allocatable **parm::sp_k**
- real ∗8, dimension(:,:), allocatable **parm::ft_qpnd**
- real ∗8, dimension(:,:), allocatable **parm::sp_dp**
- real ∗8, dimension(:,:), allocatable **parm::ft_qsw**
- real ∗8, dimension(:,:), allocatable **parm::ft_qin**
- real ∗8, dimension(:,:), allocatable **parm::ft_qout**
- real ∗8, dimension(:,:), allocatable **parm::ft_sedpnd**
- real ∗8, dimension(:,:), allocatable **parm::sp_bpw**
- real ∗8, dimension(:,:), allocatable **parm::ft_bpw**
- real ∗8, dimension(:,:), allocatable **parm::ft_sed_cumul**
- real ∗8, dimension(:,:), allocatable **parm::sp_sed_cumul**
- integer, dimension(:), allocatable **parm::num_sf**
- integer, dimension(:,:), allocatable **parm::sf_typ**
- integer, dimension(:,:), allocatable **parm::sf_dim**
- integer, dimension(:,:), allocatable **parm::ft_qfg**
- integer, dimension(:,:), allocatable **parm::sp_qfg**
- integer, dimension(:,:), allocatable **parm::sf_ptp**
- integer, dimension(:,:), allocatable **parm::ft_fc**
- real ∗8 **parm::sfsedmean**
- real ∗8 **parm::sfsedstdev**
- integer, dimension(:), allocatable parm::dtp_imo

  month the reservoir becomes operational (none)
- integer, dimension(:), allocatable parm::dtp_iyr

  year of the simulation that the reservoir becomes operational (none)
- integer, dimension(:), allocatable parm::dtp_numstage

  total number of stages in the weir (none)
- integer, dimension(:), allocatable parm::dtp_numweir

  total number of weirs in the BMP (none)
- integer, dimension(:), allocatable parm::dtp_onoff

  sub-basin detention pond is associated with (none)

- integer, dimension(:), allocatable parm::dtp_reltype

  equations for stage-discharge relationship (none):
  1=exponential function,
  2=linear,
  3=logarithmic,
  4=cubic,
  5=power
- integer, dimension(:), allocatable parm::dtp_stagdis

  (none):
  0=use weir/orifice discharge equation to calculate outflow,
  1=use stage-dicharge relationship
- integer, dimension(:), allocatable **parm::dtp_subnum**
- real ∗8, dimension(:), allocatable parm::cf

  this parameter controls the response of decomposition to the combined effect of soil temperature and moisture.
- real ∗8, dimension(:), allocatable parm::cfh

  maximum humification rate
- real ∗8, dimension(:), allocatable parm::cfdec

  the undisturbed soil turnover rate under optimum soil water and temperature. Increasing it will increase carbon and organic N decomp.
- real ∗8, dimension(:), allocatable **parm::lat_orgn**
- real ∗8, dimension(:), allocatable **parm::lat_orgp**
- integer, dimension(:,:), allocatable parm::dtp_weirdim

  weir dimensions (none),
  1=read user input,
  0=use model calculation
- integer, dimension(:,:), allocatable parm::dtp_weirtype

  type of weir (none):
  1=rectangular and
  2=circular
- real ∗8, dimension(:), allocatable parm::dtp_coef1

  coefficient of 3rd degree in the polynomial equation (none)
- real ∗8, dimension(:), allocatable parm::dtp_coef2

  coefficient of 2nd degree in the polynomial equation (none)
- real ∗8, dimension(:), allocatable parm::dtp_coef3

  coefficient of 1st degree in the polynomial equation (none)
- real ∗8, dimension(:), allocatable parm::dtp_evrsv

  detention pond evaporation coefficient (none)
- real ∗8, dimension(:), allocatable parm::dtp_expont

  exponent used in the exponential equation (none)
- real ∗8, dimension(:), allocatable parm::dtp_intcept

  intercept used in regression equations (none)
- real ∗8, dimension(:), allocatable parm::dtp_lwratio

  ratio of length to width of water back up (none)
- real ∗8, dimension(:), allocatable parm::dtp_totwrwid

  total constructed width of the detention wall across the creek (m)
- real ∗8, dimension(:), allocatable **parm::dtp_inflvol**
- real ∗8, dimension(:), allocatable **parm::dtp_wdep**
- real ∗8, dimension(:), allocatable **parm::dtp_totdep**
- real ∗8, dimension(:), allocatable **parm::dtp_watdepact**
- real ∗8, dimension(:), allocatable **parm::dtp_outflow**
- real ∗8, dimension(:), allocatable **parm::dtp_totrel**
- real ∗8, dimension(:), allocatable **parm::dtp_backoff**
- real ∗8, dimension(:), allocatable **parm::dtp_seep_sa**
- real ∗8, dimension(:), allocatable **parm::dtp_evap_sa**

- real ∗8, dimension(:), allocatable **parm::dtp_pet_day**
- real ∗8, dimension(:), allocatable **parm::dtp_pcpvol**
- real ∗8, dimension(:), allocatable **parm::dtp_seepvol**
- real ∗8, dimension(:), allocatable **parm::dtp_evapvol**
- real ∗8, dimension(:), allocatable **parm::dtp_flowin**
- real ∗8, dimension(:), allocatable **parm::dtp_backup_length**
- real ∗8, dimension(:), allocatable **parm::dtp_ivol**
- real ∗8, dimension(:), allocatable **parm::dtp_ised**
- integer, dimension(:,:), allocatable **parm::so_res_flag**
- integer, dimension(:,:), allocatable **parm::ro_bmp_flag**
- real ∗8, dimension(:,:), allocatable **parm::sol_watp**
- real ∗8, dimension(:,:), allocatable **parm::sol_solp_pre**
- real ∗8, dimension(:,:), allocatable **parm::psp_store**
- real ∗8, dimension(:,:), allocatable **parm::ssp_store**
- real ∗8, dimension(:,:), allocatable **parm::so_res**
- real ∗8, dimension(:,:), allocatable **parm::sol_cal**
- real ∗8, dimension(:,:), allocatable **parm::sol_ph**
- integer **parm::sol_p_model**
- integer, dimension(:,:), allocatable **parm::a_days**
- integer, dimension(:,:), allocatable **parm::b_days**
- real ∗8, dimension(:), allocatable parm::min_res

  minimum residue allowed due to implementation of residue managment in the OPS file (kg/ha)
- real ∗8, dimension(:), allocatable **parm::harv_min**
- real ∗8, dimension(:), allocatable **parm::fstap**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_flo**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_sed**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_bac**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_pp**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_sp**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_pn**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_sn**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_flos**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_seds**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_bacs**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_pps**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_sps**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_pns**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_sns**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_flot**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_sedt**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_bact**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_ppt**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_spt**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_pnt**
- real ∗8, dimension(:,:), allocatable **parm::ro_bmp_snt**
- real ∗8, dimension(:), allocatable **parm::bmp_flo**
- real ∗8, dimension(:), allocatable **parm::bmp_sed**
- real ∗8, dimension(:), allocatable **parm::bmp_bac**
- real ∗8, dimension(:), allocatable **parm::bmp_pp**
- real ∗8, dimension(:), allocatable **parm::bmp_sp**
- real ∗8, dimension(:), allocatable **parm::bmp_pn**
- real ∗8, dimension(:), allocatable **parm::bmp_sn**
- real ∗8, dimension(:), allocatable **parm::bmp_flag**
- real ∗8, dimension(:), allocatable **parm::bmp_flos**

- real ∗8, dimension(:), allocatable **parm::bmp_seds**
- real ∗8, dimension(:), allocatable **parm::bmp_bacs**
- real ∗8, dimension(:), allocatable **parm::bmp_pps**
- real ∗8, dimension(:), allocatable **parm::bmp_sps**
- real ∗8, dimension(:), allocatable **parm::bmp_pns**
- real ∗8, dimension(:), allocatable **parm::bmp_sns**
- real ∗8, dimension(:), allocatable **parm::bmp_flot**
- real ∗8, dimension(:), allocatable **parm::bmp_sedt**
- real ∗8, dimension(:), allocatable **parm::bmp_bact**
- real ∗8, dimension(:), allocatable **parm::bmp_ppt**
- real ∗8, dimension(:), allocatable **parm::bmp_spt**
- real ∗8, dimension(:), allocatable **parm::bmp_pnt**
- real ∗8, dimension(:), allocatable **parm::bmp_snt**
- real ∗8, dimension(:,:), allocatable parm::dtp_addon

  the distance between spillway levels (m)
- real ∗8, dimension(:,:), allocatable parm::dtp_cdis

  discharge coefficient for weir/orifice flow at different stages (none)
- real ∗8, dimension(:,:), allocatable parm::dtp_depweir

  depth of rectangular weir at different stages (m)
- real ∗8, dimension(:,:), allocatable parm::dtp_diaweir

  diameter of circular weir at different stages (m)
- real ∗8, dimension(:,:), allocatable parm::dtp_flowrate

  maximum discharge from each stage of the weir/hole (m^3/s)
- real ∗8, dimension(:,:), allocatable parm::dtp_pcpret

  precipitation for different return periods (not used) (mm)
- real ∗8, dimension(:,:), allocatable parm::dtp_retperd

  return period at different stages (years)
- real ∗8, dimension(:,:), allocatable parm::dtp_wdratio

  width depth ratio of rectangular weirs at different stages (none)
- real ∗8, dimension(:,:), allocatable **parm::dtp_wrwid**
- real ∗8, dimension(:), allocatable **parm::ri_subkm**
- real ∗8, dimension(:), allocatable **parm::ri_totpvol**
- real ∗8, dimension(:), allocatable **parm::irmmdt**
- real ∗8, dimension(:,:), allocatable parm::ri_sed

  total sediment deposited in the pond (tons)
- real ∗8, dimension(:,:), allocatable **parm::ri_fr**
- real ∗8, dimension(:,:), allocatable **parm::ri_dim**
- real ∗8, dimension(:,:), allocatable **parm::ri_im**
- real ∗8, dimension(:,:), allocatable **parm::ri_iy**
- real ∗8, dimension(:,:), allocatable **parm::ri_sa**
- real ∗8, dimension(:,:), allocatable **parm::ri_vol**
- real ∗8, dimension(:,:), allocatable **parm::ri_qi**
- real ∗8, dimension(:,:), allocatable **parm::ri_k**
- real ∗8, dimension(:,:), allocatable **parm::ri_dd**
- real ∗8, dimension(:,:), allocatable **parm::ri_evrsv**
- real ∗8, dimension(:,:), allocatable **parm::ri_dep**
- real ∗8, dimension(:,:), allocatable **parm::ri_ndt**
- real ∗8, dimension(:,:), allocatable **parm::ri_pmpvol**
- real ∗8, dimension(:,:), allocatable **parm::ri_sed_cumul**
- real ∗8, dimension(:,:), allocatable **parm::hrnopcp**
- real ∗8, dimension(:,:), allocatable **parm::ri_qloss**
- real ∗8, dimension(:,:), allocatable **parm::ri_pumpv**
- real ∗8, dimension(:,:), allocatable **parm::ri_sedi**

- character(len=4), dimension(:,:), allocatable **parm::ri_nirr**
- integer, dimension(:), allocatable **parm::num_ri**
- integer, dimension(:), allocatable **parm::ri_luflg**
- integer, dimension(:), allocatable **parm::num_noirr**
- integer, dimension(:), allocatable **parm::wtp_subnum**
- integer, dimension(:), allocatable **parm::wtp_onoff**
- integer, dimension(:), allocatable **parm::wtp_imo**
- integer, dimension(:), allocatable **parm::wtp_iyr**
- integer, dimension(:), allocatable **parm::wtp_dim**
- integer, dimension(:), allocatable **parm::wtp_stagdis**
- integer, dimension(:), allocatable **parm::wtp_sdtype**
- real ∗8, dimension(:), allocatable parm::wtp_evrsv

  detention pond evaporation coefficient (none)
- real ∗8, dimension(:), allocatable parm::wtp_pvol

  volume of permanent pool including forebay (m^3 H2O)
- real ∗8, dimension(:), allocatable **parm::wtp_pdepth**
- real ∗8, dimension(:), allocatable **parm::wtp_sdslope**
- real ∗8, dimension(:), allocatable **parm::wtp_lenwdth**
- real ∗8, dimension(:), allocatable **parm::wtp_extdepth**
- real ∗8, dimension(:), allocatable **parm::wtp_hydeff**
- real ∗8, dimension(:), allocatable **parm::wtp_sdintc**
- real ∗8, dimension(:), allocatable **parm::wtp_sdexp**
- real ∗8, dimension(:), allocatable **parm::wtp_sdc1**
- real ∗8, dimension(:), allocatable **parm::wtp_sdc2**
- real ∗8, dimension(:), allocatable **parm::wtp_sdc3**
- real ∗8, dimension(:), allocatable **parm::wtp_pdia**
- real ∗8, dimension(:), allocatable **parm::wtp_plen**
- real ∗8, dimension(:), allocatable **parm::wtp_pmann**
- real ∗8, dimension(:), allocatable **parm::wtp_ploss**
- real ∗8, dimension(:), allocatable **parm::wtp_k**
- real ∗8, dimension(:), allocatable **parm::wtp_dp**
- real ∗8, dimension(:), allocatable **parm::wtp_sedi**
- real ∗8, dimension(:), allocatable **parm::wtp_sede**
- real ∗8, dimension(:), allocatable **parm::wtp_qi**
- real ∗8 parm::lai_init

  initial leaf area index of transplants
- real ∗8 parm::bio_init

  initial biomass of transplants (kg/ha)
- real ∗8 parm::cnop

  SCS runoff curve number for moisture condition II (none)
- real ∗8 parm::harveff

  harvest efficiency: fraction of harvested yield that is removed from HRU; the remainder becomes residue on the soil surface(none)
- real ∗8 parm::hi_ovr

  harvest index target specified at harvest ((kg/ha)/(kg/ha))
- real ∗8 **parm::frac_harvk**
- real ∗8 parm::lid_vgcl

  van Genuchten equation's coefficient, l (none)
- real ∗8 parm::lid_vgcm

  van Genuchten equation's coefficient, m (none)
- real ∗8 **parm::lid_qsurf_total**
- real ∗8 **parm::lid_farea_sum**
- real ∗8, dimension(:,:), allocatable parm::lid_cuminf_last

cumulative amount of water infiltrated into the amended soil layer at the last time step in a day (mm H2O)
- real ∗8, dimension(:,:), allocatable parm::lid_cumr_last

  cumulative amount of rainfall at the last time step in a day (mm H2O)
- real ∗8, dimension(:,:), allocatable parm::lid_excum_last

  cumulative amount of excess rainfall at the last time step in a day (mm H2O)
- real ∗8, dimension(:,:), allocatable parm::lid_f_last

  potential infiltration rate of the amended soil layer at the last time step in a day (mm/mm H2O)
- real ∗8, dimension(:,:), allocatable parm::lid_sw_last

  soil water content of the amended soil layer at the last time step in a day (mm/mm H2O)
- real ∗8, dimension(:,:), allocatable parm::lid_qsurf

  depth of runoff generated on a LID in a given time interval (mm H2O)
- real ∗8, dimension(:,:), allocatable **parm::interval_last**
- real ∗8, dimension(:,:), allocatable **parm::lid_str_last**
- real ∗8, dimension(:,:), allocatable **parm::lid_farea**
- real ∗8, dimension(:,:), allocatable **parm::lid_sw_add**
- real ∗8, dimension(:,:), allocatable **parm::lid_cumqperc_last**
- real ∗8, dimension(:,:), allocatable **parm::lid_cumirr_last**
- integer, dimension(:,:), allocatable **parm::gr_onoff**
- integer, dimension(:,:), allocatable **parm::gr_imo**
- integer, dimension(:,:), allocatable **parm::gr_iyr**
- real ∗8, dimension(:,:), allocatable parm::gr_farea

  fractional area of a green roof to the HRU (none)
- real ∗8, dimension(:,:), allocatable **parm::gr_solop**
- real ∗8, dimension(:,:), allocatable **parm::gr_etcoef**
- real ∗8, dimension(:,:), allocatable **parm::gr_fc**
- real ∗8, dimension(:,:), allocatable **parm::gr_wp**
- real ∗8, dimension(:,:), allocatable **parm::gr_ksat**
- real ∗8, dimension(:,:), allocatable **parm::gr_por**
- real ∗8, dimension(:,:), allocatable **parm::gr_hydeff**
- real ∗8, dimension(:,:), allocatable **parm::gr_soldpt**
- integer, dimension(:,:), allocatable **parm::rg_onoff**
- integer, dimension(:,:), allocatable **parm::rg_imo**
- integer, dimension(:,:), allocatable **parm::rg_iyr**
- real ∗8, dimension(:,:), allocatable **parm::rg_farea**
- real ∗8, dimension(:,:), allocatable **parm::rg_solop**
- real ∗8, dimension(:,:), allocatable **parm::rg_etcoef**
- real ∗8, dimension(:,:), allocatable **parm::rg_fc**
- real ∗8, dimension(:,:), allocatable **parm::rg_wp**
- real ∗8, dimension(:,:), allocatable **parm::rg_ksat**
- real ∗8, dimension(:,:), allocatable **parm::rg_por**
- real ∗8, dimension(:,:), allocatable **parm::rg_hydeff**
- real ∗8, dimension(:,:), allocatable **parm::rg_soldpt**
- real ∗8, dimension(:,:), allocatable **parm::rg_dimop**
- real ∗8, dimension(:,:), allocatable **parm::rg_sarea**
- real ∗8, dimension(:,:), allocatable **parm::rg_vol**
- real ∗8, dimension(:,:), allocatable **parm::rg_sth**
- real ∗8, dimension(:,:), allocatable **parm::rg_sdia**
- real ∗8, dimension(:,:), allocatable **parm::rg_bdia**
- real ∗8, dimension(:,:), allocatable **parm::rg_sts**
- real ∗8, dimension(:,:), allocatable **parm::rg_orifice**
- real ∗8, dimension(:,:), allocatable **parm::rg_oheight**
- real ∗8, dimension(:,:), allocatable **parm::rg_odia**
- integer, dimension(:,:), allocatable **parm::cs_onoff**
- integer, dimension(:,:), allocatable **parm::cs_imo**

- integer, dimension(:,:), allocatable **parm::cs_iyr**
- integer, dimension(:,:), allocatable **parm::cs_grcon**
- real ∗8, dimension(:,:), allocatable **parm::cs_farea**
- real ∗8, dimension(:,:), allocatable **parm::cs_vol**
- real ∗8, dimension(:,:), allocatable **parm::cs_rdepth**
- integer, dimension(:,:), allocatable **parm::pv_onoff**
- integer, dimension(:,:), allocatable **parm::pv_imo**
- integer, dimension(:,:), allocatable **parm::pv_iyr**
- integer, dimension(:,:), allocatable **parm::pv_solop**
- real ∗8, dimension(:,:), allocatable **parm::pv_grvdep**
- real ∗8, dimension(:,:), allocatable **parm::pv_grvpor**
- real ∗8, dimension(:,:), allocatable **parm::pv_farea**
- real ∗8, dimension(:,:), allocatable **parm::pv_drcoef**
- real ∗8, dimension(:,:), allocatable **parm::pv_fc**
- real ∗8, dimension(:,:), allocatable **parm::pv_wp**
- real ∗8, dimension(:,:), allocatable **parm::pv_ksat**
- real ∗8, dimension(:,:), allocatable **parm::pv_por**
- real ∗8, dimension(:,:), allocatable **parm::pv_hydeff**
- real ∗8, dimension(:,:), allocatable **parm::pv_soldpt**
- integer, dimension(:,:), allocatable **parm::lid_onoff**
- real ∗8, dimension(:,:), allocatable parm::sol_hsc

  mass of C present in slow humus (kg ha-1)
- real ∗8, dimension(:,:), allocatable parm::sol_hsn

  mass of N present in slow humus (kg ha-1)
- real ∗8, dimension(:,:), allocatable parm::sol_hpc

  mass of C present in passive humus (kg ha-1)
- real ∗8, dimension(:,:), allocatable parm::sol_hpn

  mass of N present in passive humus (kg ha-1)
- real ∗8, dimension(:,:), allocatable parm::sol_lm

  mass of metabolic litter (kg ha-1)
- real ∗8, dimension(:,:), allocatable parm::sol_lmc

  mass of C in metabolic litter (kg ha-1)
- real ∗8, dimension(:,:), allocatable parm::sol_lmn

  mass of N in metabolic litter (kg ha-1)
- real ∗8, dimension(:,:), allocatable parm::sol_ls

  mass of structural litter (kg ha-1)
- real ∗8, dimension(:,:), allocatable parm::sol_lsc

  mass of C in structural litter (kg ha-1)
- real ∗8, dimension(:,:), allocatable parm::sol_lsl

  mass of lignin in structural litter (kg ha-1)
- real ∗8, dimension(:,:), allocatable parm::sol_lsn

  mass of N in structural litter (kg ha-1)
- real ∗8, dimension(:,:), allocatable **parm::sol_bmc**
- real ∗8, dimension(:,:), allocatable **parm::sol_bmn**
- real ∗8, dimension(:,:), allocatable **parm::sol_rnmn**
- real ∗8, dimension(:,:), allocatable **parm::sol_lslc**
- real ∗8, dimension(:,:), allocatable **parm::sol_lslnc**
- real ∗8, dimension(:,:), allocatable **parm::sol_rspc**
- real ∗8, dimension(:,:), allocatable **parm::sol_woc**
- real ∗8, dimension(:,:), allocatable **parm::sol_won**
- real ∗8, dimension(:,:), allocatable **parm::sol_hp**
- real ∗8, dimension(:,:), allocatable **parm::sol_hs**
- real ∗8, dimension(:,:), allocatable **parm::sol_bm**

- real ∗8, dimension(:,:), allocatable **parm::sol_cac**
- real ∗8, dimension(:,:), allocatable **parm::sol_cec**
- real ∗8, dimension(:,:), allocatable **parm::sol_percc**
- real ∗8, dimension(:,:), allocatable **parm::sol_latc**
- real ∗8, dimension(:), allocatable parm::sedc_d

    amount of C lost with sediment pools (kg C/ha)
- real ∗8, dimension(:), allocatable **parm::surfqc_d**
- real ∗8, dimension(:), allocatable **parm::latc_d**
- real ∗8, dimension(:), allocatable **parm::percc_d**
- real ∗8, dimension(:), allocatable **parm::foc_d**
- real ∗8, dimension(:), allocatable **parm::nppc_d**
- real ∗8, dimension(:), allocatable **parm::rsdc_d**
- real ∗8, dimension(:), allocatable **parm::grainc_d**
- real ∗8, dimension(:), allocatable **parm::stoverc_d**
- real ∗8, dimension(:), allocatable **parm::soc_d**
- real ∗8, dimension(:), allocatable **parm::rspc_d**
- real ∗8, dimension(:), allocatable **parm::emitc_d**
- real ∗8, dimension(:), allocatable **parm::sub_sedc_d**
- real ∗8, dimension(:), allocatable **parm::sub_surfqc_d**
- real ∗8, dimension(:), allocatable **parm::sub_latc_d**
- real ∗8, dimension(:), allocatable **parm::sub_percc_d**
- real ∗8, dimension(:), allocatable **parm::sub_foc_d**
- real ∗8, dimension(:), allocatable **parm::sub_nppc_d**
- real ∗8, dimension(:), allocatable **parm::sub_rsdc_d**
- real ∗8, dimension(:), allocatable **parm::sub_grainc_d**
- real ∗8, dimension(:), allocatable **parm::sub_stoverc_d**
- real ∗8, dimension(:), allocatable **parm::sub_emitc_d**
- real ∗8, dimension(:), allocatable **parm::sub_soc_d**
- real ∗8, dimension(:), allocatable **parm::sub_rspc_d**
- real ∗8, dimension(:), allocatable **parm::sedc_m**
- real ∗8, dimension(:), allocatable **parm::surfqc_m**
- real ∗8, dimension(:), allocatable **parm::latc_m**
- real ∗8, dimension(:), allocatable **parm::percc_m**
- real ∗8, dimension(:), allocatable **parm::foc_m**
- real ∗8, dimension(:), allocatable **parm::nppc_m**
- real ∗8, dimension(:), allocatable **parm::rsdc_m**
- real ∗8, dimension(:), allocatable **parm::grainc_m**
- real ∗8, dimension(:), allocatable **parm::stoverc_m**
- real ∗8, dimension(:), allocatable **parm::emitc_m**
- real ∗8, dimension(:), allocatable **parm::soc_m**
- real ∗8, dimension(:), allocatable **parm::rspc_m**
- real ∗8, dimension(:), allocatable **parm::sedc_a**
- real ∗8, dimension(:), allocatable **parm::surfqc_a**
- real ∗8, dimension(:), allocatable **parm::latc_a**
- real ∗8, dimension(:), allocatable **parm::percc_a**
- real ∗8, dimension(:), allocatable **parm::foc_a**
- real ∗8, dimension(:), allocatable **parm::nppc_a**
- real ∗8, dimension(:), allocatable **parm::rsdc_a**
- real ∗8, dimension(:), allocatable **parm::grainc_a**
- real ∗8, dimension(:), allocatable **parm::stoverc_a**
- real ∗8, dimension(:), allocatable **parm::emitc_a**
- real ∗8, dimension(:), allocatable **parm::soc_a**
- real ∗8, dimension(:), allocatable **parm::rspc_a**
- integer, dimension(:), allocatable **parm::tillage_switch**

- real ∗8, dimension(:), allocatable **parm::tillage_depth**
- integer, dimension(:), allocatable **parm::tillage_days**
- real ∗8, dimension(:), allocatable **parm::tillage_factor**
- real ∗8 parm::dthy

    time interval for subdaily flood routing
- integer, dimension(4) **parm::ihx**
- integer, dimension(:), allocatable **parm::nhy**
- real ∗8, dimension(:), allocatable **parm::rchx**
- real ∗8, dimension(:), allocatable **parm::rcss**
- real ∗8, dimension(:), allocatable **parm::qcap**
- real ∗8, dimension(:), allocatable **parm::chxa**
- real ∗8, dimension(:), allocatable **parm::chxp**
- real ∗8, dimension(:,:,:), allocatable **parm::qhy**
- real ∗8 **parm::ff1**
- real ∗8 **parm::ff2**

5.97.1 Detailed Description

file containing the module parm

Author

modified by Javier Burguete Tolosa

5.98 ndenit.f90 File Reference

Functions/Subroutines

- subroutine ndenit (k, j, cdg, wdn, void)

    this subroutine computes denitrification

5.98.1 Detailed Description

file containing the subroutine ndenit

Author

modified by Javier Burguete

5.98.2 Function/Subroutine Documentation

5.98.2.1 ndenit()

```
subroutine ndenit (
            integer, intent(in) k,
            integer, intent(in) j,
            real*8, intent(in) cdg,
            real*8, intent(out) wdn,
            real*8, intent(in) void )
```

this subroutine computes denitrification

Parameters

in	*k*	
in	*j*	
in	*cdg*	
in	*wdn*	
out	*void*	

5.99 newtillmix.f90 File Reference

Functions/Subroutines

- subroutine newtillmix (j, bmix)

  this subroutine mixes residue and nutrients during tillage and biological mixing. Mixing was extended to all layers. A subroutine to simulate stimulation of organic matter decomposition was added. March 2009: testing has been minimal and further adjustments are expected. Use with caution!

5.99.1 Detailed Description

file containing the subroutine newtillmix

Author

Armen R. Kemanian,
Stefan Julich,
Cole Rossi
modified by Javier Burguete

5.99.2 Function/Subroutine Documentation

5.99.2.1 newtillmix()

```
subroutine newtillmix (
            integer, intent(in) j,
            real*8, intent(in) bmix )
```

this subroutine mixes residue and nutrients during tillage and biological mixing. Mixing was extended to all layers. A subroutine to simulate stimulation of organic matter decomposition was added. March 2009: testing has been minimal and further adjustments are expected. Use with caution!

Parameters

in	*j*	HRU number (none)
in	*bmix*	biological mixing efficiency: this number is zero for tillage operations (none)

5.100 nfix.f90 File Reference

Functions/Subroutines

- subroutine nfix (j)
  this subroutine estimates nitrogen fixation by legumes

5.100.1 Detailed Description

file containing the subroutine nfix

Author

modified by Javier Burguete

5.100.2 Function/Subroutine Documentation

5.100.2.1 nfix()

```
subroutine nfix (
            integer, intent(in) j )
```

this subroutine estimates nitrogen fixation by legumes

Parameters

in	*j*	HRU number

5.101 nitvol.f90 File Reference

Functions/Subroutines

- subroutine nitvol (j)
  this subroutine estimates daily mineralization (NH3 to NO3) and volatilization of NH3

5.101.1 Detailed Description

file containing the subroutine nitvol

Author

modified by Javier Burguete

5.101.2 Function/Subroutine Documentation

5.101.2.1 nitvol()

```
subroutine nitvol (
            integer, intent(in) j )
```

this subroutine estimates daily mineralization (NH3 to NO3) and volatilization of NH3

Parameters

j	HRU number

5.102 nlch.f90 File Reference

Functions/Subroutines

- subroutine nlch (j)

  this subroutine simulates the loss of nitrate via surface runoff, lateral flow, tile flow, and percolation out of the profile

5.102.1 Detailed Description

file containing the subroutine nlch

Author

modified by Javier Burguete

5.102.2 Function/Subroutine Documentation

5.102.2.1 nlch()

```
subroutine nlch (
            integer, intent(in) j )
```

this subroutine simulates the loss of nitrate via surface runoff, lateral flow, tile flow, and percolation out of the profile

Parameters

in	*j*	HRU number

5.103 nminrl.f90 File Reference

Functions/Subroutines

- subroutine nminrl (j)

  this subroutine estimates daily nitrogen and phosphorus mineralization and immobilization considering fresh organic material (plant residue) and active and stable humus material

5.103.1 Detailed Description

file containing the subroutine nminrl

Author

modified by Javier Burguete

5.103.2 Function/Subroutine Documentation

5.103.2.1 nminrl()

```
subroutine nminrl (
            integer, intent(in) j )
```

this subroutine estimates daily nitrogen and phosphorus mineralization and immobilization considering fresh organic material (plant residue) and active and stable humus material

Parameters

in	*j*	HRU number

5.104 noqual.f90 File Reference

Functions/Subroutines

- subroutine noqual (jrch)

  this subroutine performs in-stream nutrient calculations. No transformations are calculated. New concentrations of the nutrients are calculated based on the loading to the reach from upstream.

5.104.1 Detailed Description

file containing the subroutine noqual

Author

modified by Javier Burguete

5.104.2 Function/Subroutine Documentation

5.104.2.1 noqual()

```
subroutine noqual (
            integer, intent(in) jrch )
```

this subroutine performs in-stream nutrient calculations. No transformations are calculated. New concentrations of the nutrients are calculated based on the loading to the reach from upstream.

Parameters

in	*jrch*	reach number (none)

5.105 npup.f90 File Reference

Functions/Subroutines

- subroutine npup (j)

  this subroutine calculates plant phosphorus uptake

5.105.1 Detailed Description

file containing the subroutine npup

Author

modified by Javier Burguete

5.105.2 Function/Subroutine Documentation

5.105.2.1 npup()

```
subroutine npup (
            integer, intent(in) j )
```

this subroutine calculates plant phosphorus uptake

Parameters

in	*j*	HRU number

5.106 nrain.f90 File Reference

Functions/Subroutines

- subroutine nrain (j)

  this subroutine adds nitrate from rainfall to the soil profile

5.106.1 Detailed Description

file containing the subroutine nrain

Author

modified by Javier Burguete

5.106.2 Function/Subroutine Documentation

5.106.2.1 nrain()

```
subroutine nrain (
            integer, intent(in) j )
```

this subroutine adds nitrate from rainfall to the soil profile

Parameters

in	*j*	HRU number

5.107 nup.f90 File Reference

Functions/Subroutines

- subroutine nup (j)

  this subroutine calculates plant nitrogen uptake

5.107.1 Detailed Description

file containing the subroutine nup

Author

modified by Javier Burguete

5.107.2 Function/Subroutine Documentation

5.107.2.1 nup()

```
subroutine nup (
            integer, intent(in) j )
```

this subroutine calculates plant nitrogen uptake

Parameters

in	*j*	HRU number

5.108 nuts.f90 File Reference

Functions/Subroutines

- subroutine nuts (u1, u2, uu)

  this function calculates the plant stress factor caused by limited supply of nitrogen or phosphorus

5.108.1 Detailed Description

file containing the subroutine nuts

Author

modified by Javier Burguete

5.108.2 Function/Subroutine Documentation

5.108.2.1 nuts()

```
subroutine nuts (
            real*8, intent(in) u1,
            real*8, intent(in) u2,
            real*8, intent(out) uu )
```

this function calculates the plant stress factor caused by limited supply of nitrogen or phosphorus

Parameters

in	*u1*	actual amount of element in plant (kg/ha)
in	*u2*	optimal amount of element in plant (kg/ha)
out	*uu*	fraction of optimal plant growth achieved where reduction is caused by plant element deficiency (none)

5.109 openwth.f90 File Reference

Functions/Subroutines

- subroutine openwth

  this subroutine opens the precipitation, temperature, solar radiation, relative humidity and wind speed files for simulations using measured weather data

5.109.1 Detailed Description

file containing the subroutine openwth

Author

modified by Javier Burguete

5.110 operatn.f90 File Reference

Functions/Subroutines

- subroutine operatn (j)

  this subroutine performs all management operations

5.110.1 Detailed Description

file containing the subroutine operatn

Author

modified by Javier Burguete

5.110.2 Function/Subroutine Documentation

5.110.2.1 operatn()

```
subroutine operatn (
            integer, intent(in) j )
```

this subroutine performs all management operations

Parameters

in	*j*	HRU number

5.111 orgn.f90 File Reference

Functions/Subroutines

- subroutine orgn (iwave, j)

  this subroutine calculates the amount of organic nitrogen removed in surface runoff

5.111.1 Detailed Description

file containing the subroutine orgn

Author

modified by Javier Burguete

5.111.2 Function/Subroutine Documentation

5.111.2.1 orgn()

```
subroutine orgn (
            integer, intent(in) iwave,
            integer, intent(in) j )
```

this subroutine calculates the amount of organic nitrogen removed in surface runoff

Parameters

in	*iwave*	flag to differentiate calculation of HRU and subbasin sediment calculation (none) iwave = 0 for HRU iwave = subbasin # for subbasin
in	*j*	HRU number

5.112 orgncswat.f90 File Reference

Functions/Subroutines

- subroutine orgncswat (iwave, j)

  this subroutine calculates the amount of organic nitrogen removed in surface runoff - when using CSWAT it excludes sol_aorgn, uses only sol_n = sol_orgn, and includes sol_mn (nitrogen in manure)

5.112.1 Detailed Description

file containing the subroutine orgncswat

Author

modified by Javier Burguete

5.112.2 Function/Subroutine Documentation

5.112.2.1 orgncswat()

```
subroutine orgncswat (
            integer, intent(in) iwave,
            integer, intent(in) j )
```

this subroutine calculates the amount of organic nitrogen removed in surface runoff - when using CSWAT it excludes sol_aorgn, uses only sol_n = sol_orgn, and includes sol_mn (nitrogen in manure)

Parameters

in	*iwave*	flag to differentiate calculation of HRU and subbasin sediment calculation (none) iwave = 0 for HRU iwave = subbasin # for subbasin
in	*j*	HRU number

5.113 orgncswat2.f90 File Reference

Functions/Subroutines

- subroutine orgncswat2 (iwave, j)
  this subroutine calculates the amount of organic nitrogen removed in surface runoff - when using CSWAT==2 it

5.113.1 Detailed Description

file containing the subroutine orgncswat2

Author

modified by Javier Burguete

5.113.2 Function/Subroutine Documentation

5.113.2.1 orgncswat2()

```
subroutine orgncswat2 (
            integer, intent(in) iwave,
            integer, intent(in) j )
```

this subroutine calculates the amount of organic nitrogen removed in surface runoff - when using CSWAT==2 it

Parameters

in	*iwave*	flag to differentiate calculation of HRU and subbasin sediment calculation (none) iwave = 0 for HRU iwave = subbasin # for subbasin
in	*j*	HRU number

5.114 origtile.f90 File Reference

Functions/Subroutines

- subroutine origtile (d, j)

  this subroutine computes tile drainage using basic tile equations developed by Saleh et al.(2005)

5.114.1 Detailed Description

file containing the subroutine origtile

Author

modified by Javier Burguete

5.114.2 Function/Subroutine Documentation

5.114.2.1 origtile()

```
subroutine origtile (
            real*8, intent(in) d,
            integer, intent(in) j )
```

this subroutine computes tile drainage using basic tile equations developed by Saleh et al.(2005)

Parameters

in	*d*	
in	*j*	HRU number

5.115 ovr_sed.f90 File Reference

Functions/Subroutines

- subroutine ovr_sed (j)
  this subroutine computes splash erosion by raindrop impact and flow erosion by overland flow

5.115.1 Detailed Description

file containing the subroutine ovr_sed

Author

modified by Javier Burguete

5.115.2 Function/Subroutine Documentation

5.115.2.1 ovr_sed()

```
subroutine ovr_sed (
            integer, intent(in) j )
```

this subroutine computes splash erosion by raindrop impact and flow erosion by overland flow

Parameters

in	*j*	HRU number (none)

5.116 oxygen_saturation.f90 File Reference

Functions/Subroutines

- real ∗8 function oxygen_saturation (t)
  this function calculates saturation concentration for dissolved oxygen QUAL2E section 3.6.1 equation III-29

5.116.1 Detailed Description

file containing the function oxygen_saturation

Author

modified by Javier Burguete

5.116.2 Function/Subroutine Documentation

5.116.2.1 oxygen_saturation()

```
real*8 function oxygen_saturation (
            real*8, intent(in) t )
```

this function calculates saturation concentration for dissolved oxygen QUAL2E section 3.6.1 equation III-29

Parameters

in	*t*	temperature (deg C)

Returns

saturation concentration for dissolved oxygen

5.117 percmacro.f90 File Reference

Functions/Subroutines

- subroutine percmacro (j)
  this surboutine computes percolation by crack flow

5.117.1 Detailed Description

file containing the subroutine percmacro

Author

modified by Javier Burguete

5.117.2 Function/Subroutine Documentation

5.117.2.1 percmacro()

```
subroutine percmacro (
            integer, intent(in) j )
```

this surboutine computes percolation by crack flow

Parameters

in	*j*	HRU number

5.118 percmain.f90 File Reference

Functions/Subroutines

- subroutine percmain (j)

  this subroutine is the master soil percolation component

5.118.1 Detailed Description

file containing the subroutine percmain

Author

modified by Javier Burguete

5.118.2 Function/Subroutine Documentation

5.118.2.1 percmain()

```
subroutine percmain (
            integer, intent(in) j )
```

this subroutine is the master soil percolation component

Parameters

in	*j*	HRU number

5.119 percmicro.f90 File Reference

Functions/Subroutines

- subroutine percmicro (ly1, j)

  this subroutine computes percolation and lateral subsurface flow from a soil layer when field capacity is exceeded

5.119.1 Detailed Description

file containing the subroutine percmicro

Author

modified by Javier Burguete

5.119.2 Function/Subroutine Documentation

5.119.2.1 percmicro()

```
subroutine percmicro (
            integer, intent(in) ly1,
            integer, intent(in) j )
```

this subroutine computes percolation and lateral subsurface flow from a soil layer when field capacity is exceeded

Parameters

in	*ly1*	soil layer number
in	*j*	HRU number

5.120 pestlch.f90 File Reference

Functions/Subroutines

- subroutine pestlch (j)

  this subroutine calculates pesticides leached through each layer, pesticide transported with lateral subsurface flow, and pesticide transported with surface runoff

5.120.1 Detailed Description

file containing the subroutine pestlch

Author

modified by Javier Burguete

5.120.2 Function/Subroutine Documentation

5.120.2.1 pestlch()

```
subroutine pestlch (
            integer, intent(in) j )
```

this subroutine calculates pesticides leached through each layer, pesticide transported with lateral subsurface flow, and pesticide transported with surface runoff

Parameters

in	*j*	HRU number

5.121 pesty.f90 File Reference

Functions/Subroutines

- subroutine pesty (iwave, j)

5.121.1 Detailed Description

file containing the subroutine pesty

Author

modified by Javier Burguete

5.121.2 Function/Subroutine Documentation

5.121.2.1 pesty()

```
subroutine pesty (
            integer, intent(in) iwave,
            integer, intent(in) j )
```

Parameters

in	*iwave*	flag to differentiate calculation of HRU and subbasin sediment calculation (none) iwave = 0 for HRU iwave = subbasin # for subbasin
in	*j*	HRU number

5.122 pgen.f90 File Reference

Functions/Subroutines

- subroutine pgen (j)

  this subroutine generates precipitation data when the user chooses to simulate or when data is missing for particular days in the weather file

5.122.1 Detailed Description

file containing the subroutine pgen

Author

modified by Javier Burguete

5.122.2 Function/Subroutine Documentation

5.122.2.1 pgen()

```
subroutine pgen (
            integer, intent(in) j )
```

this subroutine generates precipitation data when the user chooses to simulate or when data is missing for particular days in the weather file

Parameters

in	*j*	HRU number

5.123 pgenhr.f90 File Reference

Functions/Subroutines

- subroutine pgenhr (jj)

  this subroutine distributes daily rainfall exponentially within the day @parameter[in] jj HRU number

5.123.1 Detailed Description

file containing the subroutine pgenhr

Author

modified by Javier Burguete

5.124 pipeflow.f90 File Reference

Functions/Subroutines

- real ∗8 function pipeflow (d, h)

  this function calculates orifice pipe flow and returns flow rate (m^3/s)

5.124.1 Detailed Description

file containing the function pipeflow

Author

modified by Javier Burguete

5.124.2 Function/Subroutine Documentation

5.124.2.1 pipeflow()

```
real*8 function pipeflow (
            real*8, intent(in) d,
            real*8, intent(in) h )
```

this function calculates orifice pipe flow and returns flow rate (m^3/s)

Parameters

in	*d*	diameter (mm)
in	*h*	depth (mm)

Returns

flow rate (m^3/s)

5.125 pkq.f90 File Reference

Functions/Subroutines

- subroutine pkq (iwave, j)

  this subroutine computes the peak runoff rate for each HRU and the entire subbasin using a modification of the rational formula

5.125.1 Detailed Description

file containing the subroutine pkq

Author

modified by Javier Burguete

5.125.2 Function/Subroutine Documentation

5.125.2.1 pkq()

```
subroutine pkq (
            integer, intent(in) iwave,
            integer, intent(in) j )
```

this subroutine computes the peak runoff rate for each HRU and the entire subbasin using a modification of the rational formula

Parameters

in	*iwave*	flag to differentiate calculation of HRU and subbasin sediment calculation (none) iwave = 0 for HRU MUSLE(sedyld) each hru is calculated independently using hru area and adjusted channel length iwave = 1 subbasin # for subbasin MUSLE is computed for entire subbasin using hru weighted KLSCP
in	*j*	HRU number (none)

5.126 plantmod.f90 File Reference

Functions/Subroutines

- subroutine plantmod (j)

  this subroutine predicts daily potential growth of total plant biomass and roots and calculates leaf area index. Incorporates residue for tillage functions and decays residue on ground surface. Adjusts daily dry matter based on water stress.

5.126.1 Detailed Description

file containing the subroutine plantmod

Author

modified by Javier Burguete

5.126.2 Function/Subroutine Documentation

5.126.2.1 plantmod()

```
subroutine plantmod (
            integer, intent(in) j )
```

this subroutine predicts daily potential growth of total plant biomass and roots and calculates leaf area index. Incorporates residue for tillage functions and decays residue on ground surface. Adjusts daily dry matter based on water stress.

Parameters

in	*j*	HRU number

5.127 plantop.f90 File Reference

Functions/Subroutines

- subroutine plantop (j)

  this subroutine performs the plant operation

5.127.1 Detailed Description

file containing the subroutine plantop

Author

modified by Javier Burguete

5.127.2 Function/Subroutine Documentation

5.127.2.1 plantop()

```
subroutine plantop (
            integer, intent(in) j )
```

this subroutine performs the plant operation

Parameters

in	*j*	HRU number

5.128 pmeas.f90 File Reference

Functions/Subroutines

- subroutine pmeas (i)

  this subroutine reads in precipitation data and assigns it to the proper subbasins

5.128.1 Detailed Description

file containing the subroutine pmeas

Author

modified by Javier Burguete

5.128.2 Function/Subroutine Documentation

5.128.2.1 pmeas()

```
subroutine pmeas (
            integer, intent(in) i )
```

this subroutine reads in precipitation data and assigns it to the proper subbasins

Parameters

in	*i*	current day of simulation (julian date)

5.129 pminrl.f90 File Reference

Functions/Subroutines

- subroutine pminrl (j)

  this subroutine computes p flux between the labile, active mineral and stable mineral p pools.

5.129.1 Detailed Description

file containing the subroutine pminrl

Author

modified by Javier Burguete

5.129.2 Function/Subroutine Documentation

5.129.2.1 pminrl()

```
subroutine pminrl (
            integer, intent(in) j )
```

this subroutine computes p flux between the labile, active mineral and stable mineral p pools.

Parameters

j	HRU number

5.130 pminrl2.f90 File Reference

Functions/Subroutines

- subroutine pminrl2 (j)

  this subroutine computes p flux between the labile, active mineral and stable mineral p pools. this is the alternate phosphorus model described in [5]

5.130.1 Detailed Description

file containing the subroutine pminrl2

Author

modified by Javier Burguete

5.130.2 Function/Subroutine Documentation

5.130.2.1 pminrl2()

```
subroutine pminrl2 (
            integer, intent(in) j )
```

this subroutine computes p flux between the labile, active mineral and stable mineral p pools. this is the alternate phosphorus model described in [5]

Parameters

j	HRU number

5.131 pond.f90 File Reference

Functions/Subroutines

- subroutine pond (k)
  this subroutine routes water and sediment through ponds and computes evaporation and seepage from the ponds

5.131.1 Detailed Description

file containing the subroutine pond

Author

modified by Javier Burguete

5.131.2 Function/Subroutine Documentation

5.131.2.1 pond()

```
subroutine pond (
            integer, intent(in) k )
```

this subroutine routes water and sediment through ponds and computes evaporation and seepage from the ponds

Parameters

in	*k*	HRU or reach number (none)

5.132 pondhr.f90 File Reference

Functions/Subroutines

- subroutine pondhr (j, k)

5.132.1 Detailed Description

file containing the subroutine pondhr

Author

modified by Javier Burguete

5.132.2 Function/Subroutine Documentation

5.132.2.1 pondhr()

```
subroutine pondhr (
            integer, intent(in) j,
            integer, intent(in) k )
```

Parameters

in	*j*	HRU or reach number (none)
in	*k*	current time step of the day (none)

5.133 pothole.f90 File Reference

Functions/Subroutines

- subroutine pothole (i, j)
  this subroutine simulates depressional areas that do not drain to the stream network (potholes) and impounded areas such as rice paddies

5.133.1 Detailed Description

file containing the subroutine pothole

Author

modified by Javier Burguete

5.133.2 Function/Subroutine Documentation

5.133.2.1 pothole()

```
subroutine pothole (
            integer, intent(in) i,
            integer, intent(in) j )
```

this subroutine simulates depressional areas that do not drain to the stream network (potholes) and impounded areas such as rice paddies

Parameters

in	*i*	current day in simulation–loop counter (none)
in	*j*	HRU number (none)

5.134 print_hyd.f90 File Reference

Functions/Subroutines

- subroutine print_hyd (i)
  this subroutine summarizes data for subbasins with multiple HRUs and

5.134.1 Detailed Description

file containing the subroutine print_hyd

Author

modified by Javier Burguete

5.134.2 Function/Subroutine Documentation

5.134.2.1 print_hyd()

```
subroutine print_hyd (
            integer, intent(in) i )
```

this subroutine summarizes data for subbasins with multiple HRUs and

Parameters

in	*i*	current day in simulation–loop counter (julian date)

5.135 psed.f90 File Reference

Functions/Subroutines

- subroutine psed (iwave, j)

5.135.1 Detailed Description

file containing the subroutine psed

Author

modified by Javier Burguete

5.135.2 Function/Subroutine Documentation

5.135.2.1 psed()

```
subroutine psed (
            integer, intent(in) iwave,
            integer, intent(in) j )
```

Parameters

in	*iwave*	flag to differentiate calculation of HRU and subbasin sediment calculation (none) iwave = 0 for HRU iwave = subbasin # for subbasin
in	*j*	HRU number

5.136 qman.f90 File Reference

Functions/Subroutines

- real $*$8 function qman (x1, x2, x3, x4)

  this subroutine calculates flow rate or flow velocity using Manning's equation. If x1 is set to 1, the velocity is calculated. If x1 is set to cross-sectional area of flow, the flow rate is calculated.

5.136.1 Detailed Description

file containing the function qman

Author

modified by Javier Burguete

5.136.2 Function/Subroutine Documentation

5.136.2.1 qman()

```
real*8 function qman (
            real*8, intent(in) x1,
            real*8, intent(in) x2,
            real*8, intent(in) x3,
            real*8, intent(in) x4 )
```

this subroutine calculates flow rate or flow velocity using Manning's equation. If x1 is set to 1, the velocity is calculated. If x1 is set to cross-sectional area of flow, the flow rate is calculated.

Parameters

in	*x1*	cross-sectional flow area or 1 (m^2 or none)
in	*x2*	hydraulic radius (m)
in	*x3*	Manning's "n" value for channel (none)
in	*x4*	average slope of channel (m/m)

Returns

flow rate or flow velocity (m^3/s or m/s)

5.137 rchaa.f90 File Reference

Functions/Subroutines

- subroutine rchaa (years)

  this subroutine writes the average annual reach output to the .rch file

5.137.1 Detailed Description

file containing the subroutine rchaa

Author

modified by Javier Burguete

5.137.2 Function/Subroutine Documentation

5.137.2.1 rchaa()

```
subroutine rchaa (
            real*8, intent(in) years )
```

this subroutine writes the average annual reach output to the .rch file

Parameters

in	*years*	length of simulation (years)

5.138 rchday.f90 File Reference

Functions/Subroutines

- subroutine rchday

  this subroutine writes the daily reach output to the .rch file

5.138.1 Detailed Description

file containing the subroutine rchday

Author

modified by Javier Burguete

5.139 rchinit.f90 File Reference

Functions/Subroutines

- subroutine rchinit

  this subroutine initializes variables for the daily simulation of the channel routing command loop

5.139.1 Detailed Description

file containing the subroutine rchinit

Author

modified by Javier Burguete

5.140 rchmon.f90 File Reference

Functions/Subroutines

- subroutine rchmon (mdays)

  this subroutine writes the monthly reach output to the .rch file

5.140.1 Detailed Description

file containing the subroutine rchmon

Author

modified by Javier Burguete

5.140.2 Function/Subroutine Documentation

5.140.2.1 rchmon()

```
subroutine rchmon (
            integer, intent(in) mdays )
```

this subroutine writes the monthly reach output to the .rch file

Parameters

in	*mdays*	number of days simulated in month

5.141 rchuse.f90 File Reference

Functions/Subroutines

- subroutine rchuse (jrch)
  this subroutine removes water from reach for consumptive water use

5.141.1 Detailed Description

file containing the subroutine rchuse

Author

modified by Javier Burguete

5.141.2 Function/Subroutine Documentation

5.141.2.1 rchuse()

```
subroutine rchuse (
            integer, intent(in) jrch )
```

this subroutine removes water from reach for consumptive water use

Parameters

in	*jrch*	reach number (none)

5.142 rchyr.f90 File Reference

Functions/Subroutines

- subroutine rchyr (i)

  this subroutine writes the annual reach output to the .rch file

5.142.1 Detailed Description

file containing the subroutine rchyr

Author

modified by Javier Burguete

5.142.2 Function/Subroutine Documentation

5.142.2.1 rchyr()

```
subroutine rchyr (
            integer, intent(in) i )
```

this subroutine writes the annual reach output to the .rch file

Parameters

in	*current*	day of simulation (julian date)

5.143 readatmodep.f90 File Reference

Functions/Subroutines

- subroutine readatmodep

  this subroutine reads the atmospheric deposition values

5.143.1 Detailed Description

file containing the subroutine readatmodep

Author

modified by Javier Burguete

5.144 readbsn.f90 File Reference

Functions/Subroutines

- subroutine readbsn

  this subroutine reads data from the basin input file (.bsn). This file contains information related to processes modeled or defined at the watershed level

5.144.1 Detailed Description

file containing the suborutine readbsn

Author

modified by Javier Burguete

5.145 readchm.f90 File Reference

Functions/Subroutines

- subroutine readchm (l)

  This subroutine reads data from the HRU/subbasin soil chemical input file (.chm). This file contains initial amounts of pesticides/nutrients in the first soil layer. (Specifics about the first soil layer are given in the .sol file.) All data in the .chm file is optional input.

5.145.1 Detailed Description

file containing the subroutine readchm

Author

modified by Javier Burguete

5.145.2 Function/Subroutine Documentation

5.145.2.1 readchm()

```
subroutine readchm (
            integer, intent(in) l )
```

This subroutine reads data from the HRU/subbasin soil chemical input file (.chm). This file contains initial amounts of pesticides/nutrients in the first soil layer. (Specifics about the first soil layer are given in the .sol file.) All data in the .chm file is optional input.

Parameters

in	*l*	HRU number (none)

5.146 readcnst.f90 File Reference

Functions/Subroutines

- subroutine readcnst (jj)

  reads in the loading information for the reccnst command

5.146.1 Detailed Description

file containing the subroutine readcnst.f90

Author

modified by Javier Burguete

5.146.2 Function/Subroutine Documentation

5.146.2.1 readcnst()

```
subroutine readcnst (
            integer, intent(in) jj )
```

reads in the loading information for the reccnst command

Parameters

in	*jj*	file number associated with reccnst command (none)

5.147 readfcst.f90 File Reference

Functions/Subroutines

- subroutine readfcst

  this subroutine reads the HRU forecast weather generator parameters from the .cst file

5.147.1 Detailed Description

file containing the subroutine readfcst

Author

modified by Javier Burguete

5.148 readfert.f90 File Reference

Functions/Subroutines

- subroutine readfert

    this subroutine reads input parameters from the fertilizer/manure (i.e. nutrient) database (fert.dat)

5.148.1 Detailed Description

file containing the subroutine readfert

Author

modified by Javier Burguete

5.149 readfig.f90 File Reference

Functions/Subroutines

- subroutine readfig

    reads in the routing information from the watershed configuration input file (.fig) and calculates the number of subbasins, reaches, and reservoirs

5.149.1 Detailed Description

file containing the subroutine readfig

Author

modified by Javier Burguete

5.150 readfile.f90 File Reference

Functions/Subroutines

- subroutine readfile

    this subroutine opens the main input and output files and reads watershed information from the file.cio

5.150.1 Detailed Description

file containing the subroutine readfile

Author

modified by Javier Burguete

5.151 readgw.f90 File Reference

Functions/Subroutines

- subroutine readgw (i, j)

  this subroutine reads the parameters from the HRU/subbasin groundwater input file (.gw)

5.151.1 Detailed Description

file containing the suroutine readgw

Author

modified by Javier Burguete

5.151.2 Function/Subroutine Documentation

5.151.2.1 readgw()

```
subroutine readgw (
            integer, intent(in) i,
            integer, intent(in) j )
```

this subroutine reads the parameters from the HRU/subbasin groundwater input file (.gw)

Parameters

in	*i*	subbasin number (none)
in	*j*	HRU number (none)

5.152 readhru.f90 File Reference

Functions/Subroutines

- subroutine readhru (i, j)

this subroutine reads data from the HRU general input file (.hru). This file contains data related to general processes modeled at the HRU level.

5.152.1 Detailed Description

file containing the subroutine readhru

Author

modified by Javier Burguete

5.152.2 Function/Subroutine Documentation

5.152.2.1 readhru()

```
subroutine readhru (
            integer, intent(in) i,
            integer, intent(in) j )
```

this subroutine reads data from the HRU general input file (.hru). This file contains data related to general processes modeled at the HRU level.

Parameters

in	*i*	subbasin number (none)
in	*j*	HRU number (none)

5.153 readinpt.f90 File Reference

Functions/Subroutines

- subroutine readinpt

  this subroutine calls subroutines which read input data for the databases and the HRUs

5.153.1 Detailed Description

file containing the subroutine readinpt

Author

modified by Javier Burguete

5.154 readlup.f90 File Reference

Functions/Subroutines

- subroutine readlup

  this subroutine reads data from the HRU/subbasin management input file (.mgt). This file contains data related to management practices used in the HRU/subbasin.

5.154.1 Detailed Description

file containing the subroutine readlup

Author

modified by Javier Burguete

5.155 readlwq.f90 File Reference

Functions/Subroutines

- subroutine readlwq (ii)

  this subroutine reads data from the lake water quality input file (.lwq). This file contains data related to initial pesticide and nutrient levels in the lake/reservoir and transformation processes occuring within the lake/reservoir. Data in the lake water quality input file is assumed to apply to all reservoirs in the watershed.

5.155.1 Detailed Description

file containing the subroutine readlwq

Author

modified by Javier Burguete

5.155.2 Function/Subroutine Documentation

5.155.2.1 readlwq()

```
subroutine readlwq (
            integer, intent(in) ii )
```

this subroutine reads data from the lake water quality input file (.lwq). This file contains data related to initial pesticide and nutrient levels in the lake/reservoir and transformation processes occuring within the lake/reservoir. Data in the lake water quality input file is assumed to apply to all reservoirs in the watershed.

Parameters

in	*ii*	reservoir number (none)

5.156 readmgt.f90 File Reference

Functions/Subroutines

- subroutine readmgt (k)

  this subroutine reads data from the HRU/subbasin management input file (.mgt). This file contains data related to management practices used in the HRU/subbasin.

5.156.1 Detailed Description

file containing the subroutine readmgt

Author

modified by Javier Burguete

5.156.2 Function/Subroutine Documentation

5.156.2.1 readmgt()

```
subroutine readmgt (
            integer, intent(in) k )
```

this subroutine reads data from the HRU/subbasin management input file (.mgt). This file contains data related to management practices used in the HRU/subbasin.

Parameters

in	*k*	HRU number (none)

5.157 readmon.f90 File Reference

Functions/Subroutines

- subroutine readmon (i)

  reads in the input data for the recmon command

5.157.1 Detailed Description

file containing the subroutine readmon

Author

modified by Javier Burguete

5.158 readops.f90 File Reference

Functions/Subroutines

- subroutine readops (k)

    this subroutine reads data from the HRU/subbasin management input file (.mgt). This file contains data related to management practices used in the HRU/subbasin.

5.158.1 Detailed Description

file containing the subroutine readops

Author

modified by Javier Burguete

5.158.2 Function/Subroutine Documentation

5.158.2.1 readops()

```
subroutine readops (
            integer, intent(in) k )
```

this subroutine reads data from the HRU/subbasin management input file (.mgt). This file contains data related to management practices used in the HRU/subbasin.

Parameters

in	*k*	HRU number (none)

5.159 readpest.f90 File Reference

Functions/Subroutines

- subroutine readpest

this subroutine reads parameters from the toxin/pesticide database (pest.dat)

5.159.1 Detailed Description

file containing the subroutine readpest

Author

modified by Javier Burguete

5.160 readplant.f90 File Reference

Functions/Subroutines

- subroutine readplant

  this subroutine reads input parameters from the landuse/landcover database (plant.dat)

5.160.1 Detailed Description

file containing the subroutine readplant

Author

modified by Javier Burguete

5.161 readpnd.f90 File Reference

Functions/Subroutines

- subroutine readpnd (i)

  This subroutine reads data from the HRU/subbasin pond input file (.pnd). This file contains data related to ponds and wetlands in the HRUs/subbasins.

5.161.1 Detailed Description

file containing the subroutine readpnd

Author

modified by Javier Burguete

5.161.2 Function/Subroutine Documentation

5.161.2.1 readpnd()

```
subroutine readpnd (
            integer, intent(in) i )
```

This subroutine reads data from the HRU/subbasin pond input file (.pnd). This file contains data related to ponds and wetlands in the HRUs/subbasins.

Parameters

in	*i*	subbasin number (none)

5.162 readres.f90 File Reference

Functions/Subroutines

- subroutine readres (i)

  the purpose of this subroutine is to read in data from the reservoir input file (.res)

5.162.1 Detailed Description

file containing the subroutine readres

Author

modified by Javier Burguete

5.162.2 Function/Subroutine Documentation

5.162.2.1 readres()

```
subroutine readres (
            integer, intent(in) i )
```

the purpose of this subroutine is to read in data from the reservoir input file (.res)

Parameters

in	*i*	reservoir number (none)

5.163 readrte.f90 File Reference

Functions/Subroutines

- subroutine readrte

  this subroutine reads data from the reach (main channel) input file (.rte). This file contains data related to channel attributes. Only one reach file should be made for each subbasin. If multiple HRUs are modeled within a subbasin, the same .rte file should be listed for all HRUs in file.cio

5.163.1 Detailed Description

file containing the subroutine readrte

Author

modified by Javier Burguete

5.164 readru.f90 File Reference

Functions/Subroutines

- subroutine readru (i)

  this subroutine reads data from the sub input file (.sub). This file contains data related to routing

5.164.1 Detailed Description

file containing the subroutine readru

Author

modified by Javier Burguete

5.164.2 Function/Subroutine Documentation

5.164.2.1 readru()

```
subroutine readru (
            integer, intent(in) i )
```

this subroutine reads data from the sub input file (.sub). This file contains data related to routing

Parameters

in	*i*	subbasin number

5.165 readsdr.f90 File Reference

Functions/Subroutines

- subroutine readsdr (j)

  this subroutine reads data from the HRU/subbasin management input file (.mgt). This file contains data related to management practices used in the HRU/subbasin.

5.165.1 Detailed Description

file containing the subroutine readsdr

Author

modified by Javier Burguete

5.165.2 Function/Subroutine Documentation

5.165.2.1 readsdr()

```
subroutine readsdr (
            integer j )
```

this subroutine reads data from the HRU/subbasin management input file (.mgt). This file contains data related to management practices used in the HRU/subbasin.

Parameters

in	*j*	HRU number (none)

5.166 readsepticbz.f90 File Reference

Functions/Subroutines

- subroutine readsepticbz (j)

  this subroutine reads data from the septic input file (.sep). This file contains information related to septic tanks modeled or defined at the watershed level

5.166.1 Detailed Description

file containing the subroutine readsepticbz

Author

modified by Javier Burguete

5.166.2 Function/Subroutine Documentation

5.166.2.1 readsepticbz()

```
subroutine readsepticbz (
            integer, intent(in) j )
```

this subroutine reads data from the septic input file (.sep). This file contains information related to septic tanks modeled or defined at the watershed level

Parameters

in	*j*	HRU number (none)

5.167 readseptwq.f90 File Reference

Functions/Subroutines

- subroutine readseptwq

  this subroutine reads input parameters from the sept wq database (septwq.dat). Information is used when a hru has septic tank.

5.167.1 Detailed Description

file containing the subroutine readseptwq

Author

C. Santhi, modified by Javier Burguete

5.167.2 Function/Subroutine Documentation

5.167.2.1 readseptwq()

```
subroutine readseptwq ( )
```

this subroutine reads input parameters from the sept wq database (septwq.dat). Information is used when a hru has septic tank.

This routine was developed by C. Santhi. Inputs for this routine are provided in septwq.dat of septic documentation. Data were compiled from [4] and [3].

5.168 readsno.f90 File Reference

Functions/Subroutines

- subroutine readsno (i)

  this subroutine reads snow data from the HRU/subbasin soil chemical input

5.168.1 Detailed Description

file containing the subroutine readsno

Author

modified by Javier Burguete

5.168.2 Function/Subroutine Documentation

5.168.2.1 readsno()

```
subroutine readsno (
            integer, intent(in) i )
```

this subroutine reads snow data from the HRU/subbasin soil chemical input

Parameters

in	*i*	subbasin number (none)

5.169 readsol.f90 File Reference

Functions/Subroutines

- subroutine readsol (k)

  this subroutine reads data from the HRU/subbasin soil properties file (.sol). This file contains data related to soil physical properties and general chemical properties

5.169.1 Detailed Description

file containing the subroutine readsol

Author

modified by Javier Burguete

5.169.2 Function/Subroutine Documentation

5.169.2.1 readsol()

```
subroutine readsol (
            integer, intent(in) k )
```

this subroutine reads data from the HRU/subbasin soil properties file (.sol). This file contains data related to soil physical properties and general chemical properties

Parameters

in	*k*	HRU number

5.170 readsub.f90 File Reference

Functions/Subroutines

- subroutine readsub (i)

  this subroutine reads data from the HRU/subbasin general input file (.sub). This file contains data related to general processes modeled at the HRU/subbasin level.

5.170.1 Detailed Description

file containing the subroutine readsub

Author

modified by Javier Burguete

5.170.2 Function/Subroutine Documentation

5.170.2.1 readsub()

```
subroutine readsub (
            integer, intent(in) i )
```

this subroutine reads data from the HRU/subbasin general input file (.sub). This file contains data related to general processes modeled at the HRU/subbasin level.

Parameters

in	*i*	subbasin number (none)

5.171 readswq.f90 File Reference

Functions/Subroutines

- subroutine readswq

  this subroutine reads parameters from the subbasin instream water quality file (.swq) and initializes the QUAL2E variables which apply to the individual subbasins

5.171.1 Detailed Description

file containing the subroutine readswq

Author

modified by Javier Burguete

5.172 readtill.f90 File Reference

Functions/Subroutines

- subroutine readtill

  this subroutine reads input data from tillage database (till.dat)

5.172.1 Detailed Description

file containing the subroutine readtill

Author

modified by Javier Burguete

5.173 readurban.f90 File Reference

Functions/Subroutines

- subroutine readurban

  this subroutine reads input parameters from the urban database (urban.dat). Information from this database is used only if the urban buildup/washoff routines are selected for the modeling of urban areas

5.173.1 Detailed Description

file containing the subroutine readurban

Author

modified by Javier Burguete

5.174 readwgn.f90 File Reference

Functions/Subroutines

- subroutine readwgn (ii)

  this subroutine reads the HRU weather generator parameters from the .wgn file

5.174.1 Detailed Description

file containing the subroutine readwgn

Author

modified by Javier Burguete

5.174.2 Function/Subroutine Documentation

5.174.2.1 readwgn()

```
subroutine readwgn (
            integer, intent(in) ii )
```

this subroutine reads the HRU weather generator parameters from the .wgn file

Parameters

in	*ii*	subbasin number (none)

5.175 readwus.f90 File Reference

Functions/Subroutines

- subroutine readwus (i)

  This subroutine reads data from the HRU/subbasin water use input file (.wus). The water use file extracts water from the subbasin and it is considered to be lost from the watershed. These variables should be used to remove water transported outside the watershed.

5.175.1 Detailed Description

file containing the subroutine readwus

Author

modified by Javier Burguete

5.175.2 Function/Subroutine Documentation

5.175.2.1 readwus()

```
subroutine readwus (
            integer, intent(in) i )
```

This subroutine reads data from the HRU/subbasin water use input file (.wus). The water use file extracts water from the subbasin and it is considered to be lost from the watershed. These variables should be used to remove water transported outside the watershed.

Parameters

in	*i*	subbasin number

5.176 readwwq.f90 File Reference

Functions/Subroutines

- subroutine readwwq

  this subroutine reads the watershed stream water quality input data (.wwq file) and initializes the QUAL2E variables which apply to the entire watershed

5.176.1 Detailed Description

file containing the subroutine readwwq

Author

modified by Javier Burguete

5.177 readyr.f90 File Reference

Functions/Subroutines

- subroutine readyr (i)

  reads in the input data for the recyear command

5.177.1 Detailed Description

file containing the subroutine readyr

Author

modified by Javier Burguete

5.177.2 Function/Subroutine Documentation

5.177.2.1 readyr()

```
subroutine readyr (
            integer, intent(in) i )
```

reads in the input data for the recyear command

Parameters

in	*i*	reservoir number (none)

5.178 regres.f90 File Reference

Functions/Subroutines

- real ∗8 function regres (k, j)

  this function calculates constituent loadings to the main channel using USGS regression equations

5.178.1 Detailed Description

file containing the function regres

Author

modified by Javier Burguete

5.178.2 Function/Subroutine Documentation

5.178.2.1 regres()

```
real*8 function regres (
            integer, intent(in) k,
            integer, intent(in) j )
```

this function calculates constituent loadings to the main channel using USGS regression equations

Parameters

in	*k*	identification code for regression data (none) 1 carbonaceous oxygen demand 2 suspended solid load 3 total nitrogen 4 total phosphorus
in	*j*	HRU number (none)

Returns

amount of constituent removed in surface runoff (kg)

5.179 resetlu.f90 File Reference

Functions/Subroutines

- subroutine resetlu

    this subroutine reads data from the HRU/subbasin management input file (.mgt). This file contains data related to management practices used in the HRU/subbasin.

5.179.1 Detailed Description

file containing the subroutine resetlu

Author

modified by Javier Burguete

5.180 rhgen.f90 File Reference

Functions/Subroutines

- subroutine rhgen (j)

    this subroutine generates weather relative humidity, solar radiation, and wind speed.

5.180.1 Detailed Description

file containing the subroutine rhgen

Author

modified by Javier Burguete

5.181 rootfr.f90 File Reference

Functions/Subroutines

- subroutine rootfr (j)

    this subroutine distributes dead root mass through the soil profile

5.181.1 Detailed Description

file containing the subroutine rootfr

Author

Armen R. Kemanian,
modified by Javier Burguete

5.181.2 Function/Subroutine Documentation

5.181.2.1 rootfr()

```
subroutine rootfr (
            integer, intent(in) j )
```

this subroutine distributes dead root mass through the soil profile

Parameters

in	*j*	HRU number

5.182 route.f90 File Reference

Functions/Subroutines

- subroutine route (i, jrch)
  this subroutine simulates channel routing

5.182.1 Detailed Description

file containing the subroutine route

Author

modified by Javier Burguete

5.182.2 Function/Subroutine Documentation

5.182.2.1 route()

```
subroutine route (
            integer, intent(in) i,
            integer, intent(in) jrch )
```

this subroutine simulates channel routing

Parameters

in	*i*	current day in simulation–loop counter (julian date)
in	*jrch*	reach number (none)

5.183 routels.f90 File Reference

Functions/Subroutines

- subroutine **routels** (iru_sub)

5.183.1 Detailed Description

file containing the subroutine routels

Author

modified by Javier Burguete

5.184 routeunit.f90 File Reference

Functions/Subroutines

- subroutine **routeunit**

5.184.1 Detailed Description

file containing the subroutine routeunit

Author

modified by Javier Burguete

5.185 rsedaa.f90 File Reference

Functions/Subroutines

- subroutine rsedaa (years)

  this subroutine writes the annual reach output to the .sed file

5.185.1 Detailed Description

file containing the subroutine rsedaa

Author

modified by Javier Burguete

5.185.2 Function/Subroutine Documentation

5.185.2.1 rsedaa()

```
subroutine rsedaa (
            real*8, intent(in) years )
```

this subroutine writes the annual reach output to the .sed file

Parameters

years	length of simulation (years)

5.186 rseday.f90 File Reference

Functions/Subroutines

- subroutine **rseday**

5.186.1 Detailed Description

file containing the subroutine rseday

Author

modified by Javier Burguete

5.187 rsedmon.f90 File Reference

Functions/Subroutines

- subroutine rsedmon (mdays)
  this subroutine writes the monthly reach output to the .sed file

5.187.1 Detailed Description

file containing the subroutine rsedmon

Author

modified by Javier Burguete

5.187.2 Function/Subroutine Documentation

5.187.2.1 rsedmon()

```
subroutine rsedmon (
            integer, intent(in) mdays )
```

this subroutine writes the monthly reach output to the .sed file

Parameters

in	*mdays*	number of days simulated in month

5.188 rsedyr.f90 File Reference

Functions/Subroutines

- subroutine rsedyr

  this subroutine writes the yearly reach output to the .sed file

5.188.1 Detailed Description

file containing the subroutine rsedyr

Author

modified by Javier Burguete

5.189 rtbact.f90 File Reference

Functions/Subroutines

- subroutine rtbact (jrch)

  this subroutine routes bacteria through the stream network

5.189.1 Detailed Description

file containing the subroutine rtbact

Author

modified by Javier Burguete

5.189.2 Function/Subroutine Documentation

5.189.2.1 rtbact()

```
subroutine rtbact (
            integer, intent(in) jrch )
```

this subroutine routes bacteria through the stream network

Parameters

in	*jrch*	reach number (none)

5.190 rtday.f90 File Reference

Functions/Subroutines

- subroutine rtday

  this subroutine routes the daily flow through the reach using a variable storage coefficient

5.190.1 Detailed Description

file containing the subroutine rtday

Author

modified by Javier Burguete

5.191 rteinit.f90 File Reference

Functions/Subroutines

- subroutine rteinit

  This subroutine reads in the areas associated with files processed with the recday, recepic, recmon and recyear commands, calculates subbasin areas, calculates reach and hydrograph node drainage areas.

5.191.1 Detailed Description

file containing the subroutine rteinit

Author

modified by Javier Burguete

5.192 rthmusk.f90 File Reference

Functions/Subroutines

- subroutine rthmusk (i)

  this subroutine routes flow through a reach using the Muskingum method at a given time step

5.192.1 Detailed Description

file containing the subroutine rthmusk

Author

code provided by Dr. Valentina Krysanova, Pottsdam Institute for Climate Impact Research, Germany.
Modified by N.Kannan, Blackland Research Center, Temple, USA.
Modified by Javier Burguete

5.193 rthpest.f90 File Reference

Functions/Subroutines

- subroutine rthpest (jrch)

  this subroutine computes the hourly stream pesticide balance (soluble and sorbed)

5.193.1 Detailed Description

file containing the subroutine rthpest

Author

modified by Javier Burguete

5.193.2 Function/Subroutine Documentation

5.193.2.1 rthpest()

```
subroutine rthpest (
            integer, intent(in) jrch )
```

this subroutine computes the hourly stream pesticide balance (soluble and sorbed)

Parameters

in	*jrch*	reach number (none)

5.194 rthsed.f90 File Reference

Functions/Subroutines

- subroutine rthsed (jrch)

  this subroutine routes sediment from subbasin to basin outlets on a sub-daily timestep Brownlie (1981) bed load model and Yang (1973, 1984) model added.

5.194.1 Detailed Description

file containing the subroutine rthsed

Author

modified by J.Jeong and N.Kannan for urban sub-hourly sediment modeling,
and by Balagi for bank erosion. Modified by Javier Burguete

5.194.2 Function/Subroutine Documentation

5.194.2.1 rthsed()

```
subroutine rthsed (
            integer, intent(in) jrch )
```

this subroutine routes sediment from subbasin to basin outlets on a sub-daily timestep Brownlie (1981) bed load model and Yang (1973, 1984) model added.

Parameters

in	*jrch*	reach number (none)

5.195 rthvsc.f90 File Reference

Functions/Subroutines

- subroutine rthvsc ()

  this subroutine routes flow at any required time step through the reach using a variable storage coefficient. Routing method: Enhanced Variable Storage routing (Jeong et al., 2014) adopted from APEX

5.195.1 Detailed Description

file containing the subroutine rthvsc

Author

modified by Javier Burguete

5.196 rtmusk.f90 File Reference

Functions/Subroutines

- subroutine rtmusk (i)

  this subroutine routes a daily flow through a reach using the Muskingum method

5.196.1 Detailed Description

file containing the subroutine rtmusk

Author

modified by Javier Burguete

5.196.2 Function/Subroutine Documentation

5.196.2.1 rtmusk()

```
subroutine rtmusk (
            integer, intent(in) i )
```

this subroutine routes a daily flow through a reach using the Muskingum method

Parameters

in	*i*	current day of simulation (none)

5.197 rtout.f90 File Reference

Functions/Subroutines

- subroutine rtout (jrch)

  this subroutine summarizes data for reaches

5.197.1 Detailed Description

file containing the subroutine rtout

Author

modified by Javier Burguete

5.197.2 Function/Subroutine Documentation

5.197.2.1 rtout()

```
subroutine rtout (
            integer, intent(in) jrch )
```

this subroutine summarizes data for reaches

Parameters

in	*jrch*	reach number (none)

5.198 rtpest.f90 File Reference

Functions/Subroutines

- subroutine rtpest (jrch)
  this subroutine computes the daily stream pesticide balance (soluble and sorbed)

5.198.1 Detailed Description

file containing the subroutine rtpest

Author

modified by Javier Burguete

5.198.2 Function/Subroutine Documentation

5.198.2.1 rtpest()

```
subroutine rtpest (
            integer, intent(in) jrch )
```

this subroutine computes the daily stream pesticide balance (soluble and sorbed)

Parameters

in	*jrch*	reach number (none)

5.199 rtsed.f90 File Reference

Functions/Subroutines

- subroutine rtsed (jrch)

  this subroutine routes sediment from subbasin to basin outlets deposition is based on fall velocity and degradation on stream

5.199.1 Detailed Description

file containing the subroutine rtsed

Author

modified by Javier Burguete

5.199.2 Function/Subroutine Documentation

5.199.2.1 rtsed()

```
subroutine rtsed (
            integer, intent(in) jrch )
```

this subroutine routes sediment from subbasin to basin outlets deposition is based on fall velocity and degradation on stream

Parameters

in	*jrch*	reach number

5.200 rtsed2.f90 File Reference

Functions/Subroutines

- subroutine rtsed2 (jrch)

  this subroutine routes sediment from subbasin to basin outlets deposition is based on fall velocity and degradation on stream. Modification to the original SWAT sediment routine. Bagnolds strempower, Kodatie (Modified Simons-Li associates), Molinas&Wu strempower and Yang's sand-gravel equation approaches combined with Einstein's deposition equation plus particle size tracking

5.200.1 Detailed Description

file containing the subroutine rtsed2

Author

Balaji Narasimhan,
Peter Allen,
modified by Javier Burguete

5.200.2 Function/Subroutine Documentation

5.200.2.1 rtsed2()

```
subroutine rtsed2 (
            integer, intent(in) jrch )
```

this subroutine routes sediment from subbasin to basin outlets deposition is based on fall velocity and degradation on stream. Modification to the original SWAT sediment routine. Bagnolds strempower, Kodatie (Modified Simons-Li associates), Molinas&Wu strempower and Yang's sand-gravel equation approaches combined with Einstein's deposition equation plus particle size tracking

Parameters

in	*jrch*	reach number

5.201 sat_excess.f90 File Reference

Functions/Subroutines

- subroutine sat_excess (j1, j)
  this subroutine is the master soil percolation component

5.201.1 Detailed Description

file containing the subroutine sat_excess

Author

modified by Javier Burguete

5.201.2 Function/Subroutine Documentation

5.201.2.1 sat_excess()

```
subroutine sat_excess (
            integer, intent(in) j1,
            integer, intent(in) j )
```

this subroutine is the master soil percolation component

Parameters

in	*j1*	counter
in	*j*	HRU number

5.202 sched_mgt.f90 File Reference

Functions/Subroutines

- subroutine sched_mgt (j)
  this subroutine performs all management operations

5.202.1 Detailed Description

file containing the subroutine sched_mgt

Author

modified by Javier Burguete

5.202.2 Function/Subroutine Documentation

5.202.2.1 sched_mgt()

```
subroutine sched_mgt (
            integer, intent(in) j )
```

this subroutine performs all management operations

Parameters

in	*j*	HRU number

5.203 schedule_ops.f90 File Reference

Functions/Subroutines

- subroutine schedule_ops (j)

    this subroutine controls the simulation of the land phase of the hydrologic cycle

5.203.1 Detailed Description

file containing the subroutine schedule_ops

Author

modified by Javier Burguete

5.203.2 Function/Subroutine Documentation

5.203.2.1 schedule_ops()

```
subroutine schedule_ops (
            integer, intent(in) j )
```

this subroutine controls the simulation of the land phase of the hydrologic cycle

Parameters

in	*j*	HRU number

5.204 sim_inityr.f90 File Reference

Functions/Subroutines

- subroutine sim_inityr

    this subroutine initializes variables at the beginning of the year

5.204.1 Detailed Description

file containing the subroutine sim_inityr

Author

modified by Javier Burguete

5.205 simulate.f90 File Reference

Functions/Subroutines

- subroutine simulate

  this subroutine contains the loops governing the modeling of processes in the watershed

5.205.1 Detailed Description

file containing the subroutine simulate

Author

modified by Javier Burguete

5.206 slrgen.f90 File Reference

Functions/Subroutines

- subroutine slrgen (j)

  this subroutine generates solar radiation

5.206.1 Detailed Description

file containing the subroutine slrgen

Author

modified by Javier Burguete

5.206.2 Function/Subroutine Documentation

5.206.2.1 slrgen()

```
subroutine slrgen (
            integer, intent(in) j )
```

this subroutine generates solar radiation

Parameters

in	*j*	HRU number

5.207 smeas.f90 File Reference

Functions/Subroutines

- subroutine smeas

  this subroutine reads in daily solar radiation data and assigns the values to the proper HRUs

5.207.1 Detailed Description

file containing the subroutine smeas

Author

modified by Javier Burguete

5.208 snom.f90 File Reference

Functions/Subroutines

- subroutine snom (j)

  this subroutine predicts daily snom melt when the average air temperature exceeds 0 degrees Celsius

5.208.1 Detailed Description

file containing the subroutine snom

Author

modified by Javier Burguete

5.208.2 Function/Subroutine Documentation

5.208.2.1 snom()

```
subroutine snom (
            integer, intent(in) j )
```

this subroutine predicts daily snom melt when the average air temperature exceeds 0 degrees Celsius

Parameters

in	*j*	HRU number

5.209 soil_chem.f90 File Reference

Functions/Subroutines

- subroutine soil_chem (ii)

    this subroutine initializes soil chemical properties

5.209.1 Detailed Description

file containing the subroutine soil_chem

Author

modified by Javier Burguete

5.209.2 Function/Subroutine Documentation

5.209.2.1 soil_chem()

```
subroutine soil_chem (
            integer, intent(in) ii )
```

this subroutine initializes soil chemical properties

Parameters

in	*ii*	HRU number

5.210 soil_phys.f90 File Reference

Functions/Subroutines

- subroutine soil_phys (ii)

    this subroutine initializes soil physical properties

5.210.1 Detailed Description

file containing the subroutine soil_phys

Author

modified by Javier Burguete

5.210.2 Function/Subroutine Documentation

5.210.2.1 soil_phys()

```
subroutine soil_phys (
            integer, intent(in) ii )
```

this subroutine initializes soil physical properties

Parameters

in	*ii*	HRU number

5.211 soil_write.f90 File Reference

Functions/Subroutines

- subroutine soil_write (i)

  this subroutine writes output to the output.sol file

5.211.1 Detailed Description

file containing the subroutine soil_write

Author

modified by Javier Burguete

5.211.2 Function/Subroutine Documentation

5.211.2.1 soil_write()

```
subroutine soil_write (
            integer, intent(in) i )
```

this subroutine writes output to the output.sol file

Parameters

in	*i*	current day in simulation - loop counter (julian date)

5.212 solp.f90 File Reference

Functions/Subroutines

- subroutine solp (j)

    this subroutine calculates the amount of phosphorus lost from the soil profile in runoff and the movement of soluble phosphorus from the first to the second layer via percolation

5.212.1 Detailed Description

file containing the subroutine solp

Author

modified by Javier Burguete

5.212.2 Function/Subroutine Documentation

5.212.2.1 solp()

```
subroutine solp (
            integer, intent(in) j )
```

this subroutine calculates the amount of phosphorus lost from the soil profile in runoff and the movement of soluble phosphorus from the first to the second layer via percolation

Parameters

in	*j*	HRU number (none)

5.213 solt.f90 File Reference

Functions/Subroutines

- subroutine solt (j)

    this subroutine estimates daily average temperature at the bottom of each soil layer @parameter[in] j HRU number

5.213.1 Detailed Description

file containing the subroutine solt

Author

modified by Javier Burguete

5.214 std1.f90 File Reference

Functions/Subroutines

- subroutine std1

  this subroutine writes general information to the standard output file and header lines to miscellaneous output files

5.214.1 Detailed Description

file containing the subroutine std1

Author

modified by Javier Burguete

5.215 std2.f90 File Reference

Functions/Subroutines

- subroutine std2

  this subroutine writes general information to the standard output file and to miscellaneous output files

5.215.1 Detailed Description

file containing the subroutine std2

Author

modified by Javier Burguete

5.216 std3.f90 File Reference

Functions/Subroutines

- subroutine std3

  this subroutine writes the annual table header to the standard output file

5.216.1 Detailed Description

file containing the subroutine std3

Author

modified by Javier Burguete

5.217 storeinitial.f90 File Reference

Functions/Subroutines

- subroutine storeinitial

  this subroutine saves initial values for variables that must be reset to rerun the simulation for different real time weather scenarios

5.217.1 Detailed Description

file containing the subroutine storeinitial

Author

modified by Javier Burguete

5.218 subbasin.f90 File Reference

Functions/Subroutines

- subroutine subbasin (i)

  this subroutine controls the simulation of the land phase of the hydrologic cycle

5.218.1 Detailed Description

file containing the subroutine subbasin

Author

modified by Javier Burguete

5.218.2 Function/Subroutine Documentation

5.218.2.1 subbasin()

```
subroutine subbasin (
            integer, intent(in) i )
```

this subroutine controls the simulation of the land phase of the hydrologic cycle

Parameters

in	*i*	current day in simulation–loop counter (julian date)

5.219 subday.f90 File Reference

Functions/Subroutines

- subroutine subday (j)

  this subroutine writes daily subbasin output to the output.sub file

5.219.1 Detailed Description

file containing the subroutine subday

Author

modified by Javier Burguete

5.219.2 Function/Subroutine Documentation

5.219.2.1 subday()

```
subroutine subday (
            integer, intent(in) j )
```

this subroutine writes daily subbasin output to the output.sub file

Parameters

in	*j*	HRU number (none)

5.220 submon.f90 File Reference

Functions/Subroutines

- subroutine submon

  this subroutine writes monthly subbasin output to the output.sub file

5.220.1 Detailed Description

file containing the subroutine submon

Author

modified by Javier Burguete

5.221 substor.f90 File Reference

Functions/Subroutines

- subroutine substor (j)

  this subroutine stores and lags lateral soil flow and nitrate

5.221.1 Detailed Description

file containing the subroutine substor

Author

modified by Javier Burguete

5.221.2 Function/Subroutine Documentation

5.221.2.1 substor()

```
subroutine substor (
            integer, intent(in) j )
```

this subroutine stores and lags lateral soil flow and nitrate

Parameters

in	*j*	HRU number (none)

5.222 subwq.f90 File Reference

Functions/Subroutines

- subroutine subwq (j)

  this subroutine computes HRU loadings of chlorophyll-a, CBOD, and dissolved oxygen to the main channel

5.222.1 Detailed Description

file containing the subroutine subwq

Author

modified by Javier Burguete

5.222.2 Function/Subroutine Documentation

5.222.2.1 subwq()

```
subroutine subwq (
            integer, intent(in) j )
```

this subroutine computes HRU loadings of chlorophyll-a, CBOD, and dissolved oxygen to the main channel

Parameters

in	*j*	HRU number (none)

5.223 subyr.f90 File Reference

Functions/Subroutines

- subroutine subyr

  this subroutine writes annual subbasin output to the output.sub file

5.223.1 Detailed Description

file containing the subroutine subyr

Author

modified by Javier Burguete

5.224 sumhyd.f90 File Reference

Functions/Subroutines

- subroutine **sumhyd**

5.224.1 Detailed Description

file containing the subroutine sumhyd

Author

modified by Javier Burguete

5.225 sumv.f90 File Reference

Functions/Subroutines

- subroutine sumv (j)
  this subroutine performs summary calculations for HRU

5.225.1 Detailed Description

file containing the subroutine sumv

Author

modified by Javier Burguete

5.225.2 Function/Subroutine Documentation

5.225.2.1 sumv()

```
subroutine sumv (
            integer, intent(in) j )
```

this subroutine performs summary calculations for HRU

Parameters

in	*j*	HRU number (none)

5.226 surface.f90 File Reference

Functions/Subroutines

- subroutine surface (i, j)
  this subroutine models surface hydrology at any desired time step

5.226.1 Detailed Description

file containing the subroutine surface

Author

modified by Javier Burguete

5.226.2 Function/Subroutine Documentation

5.226.2.1 surface()

```
subroutine surface (
            integer, intent(in) i,
            integer, intent(in) j )
```

this subroutine models surface hydrology at any desired time step

Parameters

in	*i*	current day in simulation–loop counter (julian date)
in	*j*	HRU number (none)

5.227 surfst_h2o.f90 File Reference

Functions/Subroutines

- subroutine surfst_h2o (j)

  this subroutine determines the net surface runoff reaching the main channel on a given day. The net amount of water reaching the main channel can include water in surface runoff from the previous day and will exclude surface runoff generated on the current day which takes longer than one day to reach the main channel

5.227.1 Detailed Description

file containing the subroutine surfst_h2o

Author

modified by Javier Burguete

5.227.2 Function/Subroutine Documentation

5.227.2.1 surfst_h2o()

```
subroutine surfst_h2o (
            integer, intent(in) j )
```

this subroutine determines the net surface runoff reaching the main channel on a given day. The net amount of water reaching the main channel can include water in surface runoff from the previous day and will exclude surface runoff generated on the current day which takes longer than one day to reach the main channel

Parameters

in	*j*	HRU number

5.228 surfstor.f90 File Reference

Functions/Subroutines

- subroutine surfstor (j)

  this subroutine stores and lags sediment and nutrients in surface runoff

5.228.1 Detailed Description

file containing the subroutine surfstor

Author

modified by Javier Burguete

5.228.2 Function/Subroutine Documentation

5.228.2.1 surfstor()

```
subroutine surfstor (
            integer, intent(in) j )
```

this subroutine stores and lags sediment and nutrients in surface runoff

Parameters

in	*j*	HRU number (none)

5.229 surq_daycn.f90 File Reference

Functions/Subroutines

- subroutine surq_daycn (j)

  predicts daily runoff given daily precipitation and snow melt using a modified SCS curve number approach

5.229.1 Detailed Description

file containing the subroutine surq_daycn

Author

modified by Javier Burguete

5.229.2 Function/Subroutine Documentation

5.229.2.1 surq_daycn()

```
subroutine surq_daycn (
            integer, intent(in) j )
```

predicts daily runoff given daily precipitation and snow melt using a modified SCS curve number approach

Parameters

in	*j*	HRU number (none)

5.230 surq_greenampt.f90 File Reference

Functions/Subroutines

- subroutine surq_greenampt (j)
  predicts daily runoff given breakpoint precipitation and snow melt using the Green & Ampt technique

5.230.1 Detailed Description

file containing the subroutine surq_greenampt

Author

modified by Javier Burguete

5.230.2 Function/Subroutine Documentation

5.230.2.1 surq_greenampt()

```
subroutine surq_greenampt (
            integer, intent(in) j )
```

predicts daily runoff given breakpoint precipitation and snow melt using the Green & Ampt technique

Parameters

in	*j*	HRU number (none)

5.231 swbl.f90 File Reference

Functions/Subroutines

- subroutine swbl (snow, irrg)
  this subroutine checks the soil water balance at the end of the simulation

5.231.1 Detailed Description

file containing the subroutine swbl

Author

modified by Javier Burguete

5.231.2 Function/Subroutine Documentation

5.231.2.1 swbl()

```
subroutine swbl (
            real*8, intent(in) snow,
            real*8, intent(in) irrg )
```

this subroutine checks the soil water balance at the end of the simulation

Parameters

in	*snow*	snow in watershed at end of simulation
in	*irrg*	irrigation water applied to watershed

5.232 sweep.f90 File Reference

Functions/Subroutines

- subroutine sweep (j)
  the subroutine performs the street sweeping operation

5.232.1 Detailed Description

file containing the subroutine sweep

Author

modified by Javier Burguete

5.232.2 Function/Subroutine Documentation

5.232.2.1 sweep()

```
subroutine sweep (
            integer, intent(in) j )
```

the subroutine performs the street sweeping operation

Parameters

in	*j*	HRU number (none)

5.233 swu.f90 File Reference

Functions/Subroutines

- subroutine swu (j)

  this subroutine distributes potential plant evaporation through the root zone and calculates actual plant water use based on soil water availability. Also estimates water stress factor

5.233.1 Detailed Description

file containing the subroutine swu

Author

modified by Javier Burguete

5.233.2 Function/Subroutine Documentation

5.233.2.1 swu()

```
subroutine swu (
            integer, intent(in) j )
```

this subroutine distributes potential plant evaporation through the root zone and calculates actual plant water use based on soil water availability. Also estimates water stress factor

Parameters

in	*j*	HRU number

5.234 tair.f90 File Reference

Functions/Subroutines

- real ∗8 function tair (hr, jj)

  this function approximates hourly air temperature from daily max and min temperatures as documented by Campbell (1985)

5.234.1 Detailed Description

file containing the function tair

Author

modified by Javier Burguete

5.234.2 Function/Subroutine Documentation

5.234.2.1 tair()

```
real*8 function tair (
            integer, intent(in) hr,
            integer, intent(in) jj )
```

this function approximates hourly air temperature from daily max and min temperatures as documented by Campbell (1985)

Parameters

in	*hr*	hour of the day (none)
in	*jj*	HRU number (none)

Returns

air temperature for hour in HRU (deg C)

5.235 tgen.f90 File Reference

Functions/Subroutines

- subroutine tgen (j)

  this subroutine generates temperature data when the user chooses to simulate or when data is missing for particular days in the weather file

5.235.1 Detailed Description

file containing the subroutine tgen

Author

modified by Javier Burguete

5.235.2 Function/Subroutine Documentation

5.235.2.1 tgen()

```
subroutine tgen (
            integer, intent(in) j )
```

this subroutine generates temperature data when the user chooses to simulate or when data is missing for particular days in the weather file

Parameters

in	*j*	HRU number

5.236 theta.f90 File Reference

Functions/Subroutines

- real ∗8 function theta (r20, thk, tmp)

  this function corrects rate constants for temperature. Equation is III-52 from QUAL2E

5.236.1 Detailed Description

file containing the function theta

Author

modified by Javier Burguete

5.236.2 Function/Subroutine Documentation

5.236.2.1 theta()

```
real*8 function theta (
            real*8, intent(in) r20,
            real*8, intent(in) thk,
            real*8, intent(in) tmp )
```

this function corrects rate constants for temperature. Equation is III-52 from QUAL2E

Parameters

in	*r20*	value of the reaction rate coefficient at the standard temperature (20 degrees C) (1/day)
in	*thk*	temperature adjustment factor (empirical constant for each reaction coefficient) (none)
in	*tmp*	temperature on current day (deg C)

Returns

value of the reaction rate coefficient at the local temperature (1/day)

5.237 tillfactor.f90 File Reference

Functions/Subroutines

- subroutine tillfactor (j, bmix, emix, dtil, sol_thick)
  this procedure increases tillage factor (tillagef(l,j) per layer for each operation. The tillage factor settling will depend of soil moisture (tentatively) and must be called every day. For simplicity the settling is calculated now at the soil carbon sub because soil water content is available.

5.237.1 Detailed Description

file containing the subroutine tillfactor

Author

modified by Javier Burguete

5.237.2 Function/Subroutine Documentation

5.237.2.1 tillfactor()

```
subroutine tillfactor (
            integer, intent(in) j,
            real*8, intent(in) bmix,
            real*8, intent(inout) emix,
            real*8, intent(in) dtil,
            real*8, dimension(sol_nly(j)), intent(in) sol_thick )
```

this procedure increases tillage factor (tillagef(l,j) per layer for each operation. The tillage factor settling will depend of soil moisture (tentatively) and must be called every day. For simplicity the settling is calculated now at the soil carbon sub because soil water content is available.

Parameters

in	*j*	HRU number (none)
in	*bmix*	biological mixing efficiency: this number is zero for tillage operations (none)
in,out	*emix*	mixing efficiency (none)
in	*dtil*	depth of mixing (mm)
in	*sol_thick*	The tillage factor depends on the cumulative soil disturbance rating = csdr For simplicity, csdr is a function of emix. First step is to calculate "current" csdr by inverting tillage factor function. The effect of texture on tillage factor (ZZ) is removed first (and recovered at the end of the procedure). $$YY = tillagef(l,j)/ZZ$$ Since the tillage factor function is non linear, iterations are needed. $XX = 0.5$ is the initial value that works OK for the range of values observed. If a layer is only partially tilled then emix is corrected accordingly

5.238 tmeas.f90 File Reference

Functions/Subroutines

- subroutine tmeas

  this subroutine reads in temperature data and assigns it to the HRUs

5.238.1 Detailed Description

file containing the subroutine tmeas

Author

modified by Javier Burguete

5.239 tran.f90 File Reference

Functions/Subroutines

- subroutine tran (j)

  this subroutine computes tributary channel transmission losses

5.239.1 Detailed Description

file containing the subroutine tran

Author

modified by Javier Burguete

5.239.2 Function/Subroutine Documentation

5.239.2.1 tran()

```
subroutine tran (
            integer, intent(in) j )
```

this subroutine computes tributary channel transmission losses

Parameters

in	*j*	HRU number (none)

5.240 tstr.f90 File Reference

Functions/Subroutines

- subroutine tstr (j)

  computes temperature stress for crop growth - strstmp

5.240.1 Detailed Description

file containing the subroutine tstr

Author

modified by Javier Burguete

5.240.2 Function/Subroutine Documentation

5.240.2.1 tstr()

```
subroutine tstr (
            integer, intent(in) j )
```

computes temperature stress for crop growth - strstmp

Parameters

in	*j*	HRU number

5.241 ttcoef.f90 File Reference

Functions/Subroutines

- subroutine ttcoef (k)

  this subroutine computes travel time coefficients for routing along the main channel

5.241.1 Detailed Description

file containing the subroutine ttcoef

Author

modified by Javier Burguete

5.241.2 Function/Subroutine Documentation

5.241.2.1 ttcoef()

```
subroutine ttcoef (
            integer, intent(in) k )
```

this subroutine computes travel time coefficients for routing along the main channel

Parameters

in	*k*	HRU number

5.242 ttcoef_wway.f90 File Reference

Functions/Subroutines

- subroutine ttcoef_wway (j)

  this subroutine computes travel time coefficients for routing along the main channel - grassed waterways

5.242.1 Detailed Description

file containing the subroutine ttcoef_wway

Author

modified by Javier Burguete

5.243 urb_bmp.f90 File Reference

Functions/Subroutines

- subroutine urb_bmp (j)

  this subroutine

5.243.1 Detailed Description

file containing the subroutine urb_bmp

Author

modified by Javier Burguete

5.243.2 Function/Subroutine Documentation

5.243.2.1 urb_bmp()

```
subroutine urb_bmp (
            integer, intent(in) j )
```

this subroutine

Parameters

in	*j*	HRU number (none)

5.244 urban.f90 File Reference

Functions/Subroutines

- subroutine urban (j)

  this subroutine computes loadings from urban areas using the USGS regression equations or a build-up/wash-off algorithm

5.244.1 Detailed Description

file containing the subroutine urban

Author

modified by Javier Burguete

5.244.2 Function/Subroutine Documentation

5.244.2.1 urban()

```
subroutine urban (
            integer, intent(in) j )
```

this subroutine computes loadings from urban areas using the USGS regression equations or a build-up/wash-off algorithm

Parameters

in	*j*	HRU number (none)

5.245 urbanhr.f90 File Reference

Functions/Subroutines

- subroutine urbanhr (j)

  this subroutine computes loadings from urban areas using the a build-up/wash-off algorithm at subdaily time intervals

5.245.1 Detailed Description

file containing the subroutine urbanhr

Author

modified by Javier Burguete

5.245.2 Function/Subroutine Documentation

5.245.2.1 urbanhr()

```
subroutine urbanhr (
            integer, intent(in) j )
```

this subroutine computes loadings from urban areas using the a build-up/wash-off algorithm at subdaily time intervals

Parameters

in	*j*	HRU number (none)

5.246 varinit.f90 File Reference

Functions/Subroutines

- subroutine varinit (j)

  this subroutine initializes variables for the daily simulation of the land phase of the hydrologic cycle (the subbasin command loop)

5.246.1 Detailed Description

file containing the subroutine varinit

Author

modified by Javier Burguete

5.246.2 Function/Subroutine Documentation

5.246.2.1 varinit()

```
subroutine varinit (
            integer, intent(in) j )
```

this subroutine initializes variables for the daily simulation of the land phase of the hydrologic cycle (the subbasin command loop)

Parameters

in	*j*	HRU number

5.247 vbl.f90 File Reference

Functions/Subroutines

- subroutine vbl (evx, spx, pp, qin, ox, vx1, vy, yi, yo, ysx, vf, vyf, aha)
  this subroutine checks the water and sediment balance for ponds and reservoirs at the end of a simulation

5.247.1 Detailed Description

file containing the subroutine vbl

Author

modified by Javier Burguete

5.247.2 Function/Subroutine Documentation

5.247.2.1 vbl()

```
subroutine vbl (
            real*8, intent(in) evx,
            real*8, intent(in) spx,
            real*8, intent(in) pp,
            real*8, intent(in) qin,
            real*8, intent(in) ox,
            real*8, intent(inout) vx1,
            real*8, intent(inout) vy,
            real*8, intent(in) yi,
            real*8, intent(in) yo,
            real*8, intent(in) ysx,
            real*8, intent(in) vf,
            real*8, intent(in) vyf,
            real*8, intent(in) aha )
```

this subroutine checks the water and sediment balance for ponds and reservoirs at the end of a simulation

Parameters

in	*evx*	evaporation from water body
in	*spx*	seepage from water body
in	*pp*	precipitation on water body
in	*qin*	water entering water body

Parameters

in	*ox*	water leaving water body
in,out	*vx1*	(in) volume of water in water body at beginning of simulation (out) dfw expressed as depth over drainage area
in,out	*vy*	(in) sediment in water body at beginning of simulation (out) dfy expressed as loading per unit area for drainage area
in	*yi*	sediment entering water body
in	*yo*	sediment leaving water body
in	*ysx*	change in sediment level in water body
in	*vf*	volume of water in water body at end of simulation
in	*vyf*	sediment in water body at end of simulation
in	*aha*	area draining into water body

5.248 virtual.f90 File Reference

Functions/Subroutines

- subroutine virtual (i, j, k, sb)

  this subroutine summarizes data for subbasins with multiple HRUs and prints the daily output.hru file

5.248.1 Detailed Description

file containing the subroutine virtual

Author

modified by Javier Burguete

5.248.2 Function/Subroutine Documentation

5.248.2.1 virtual()

```
subroutine virtual (
            integer, intent(in) i,
            integer, intent(in) j,
            integer, intent(in) k,
            integer, intent(in) sb )
```

this subroutine summarizes data for subbasins with multiple HRUs and prints the daily output.hru file

Parameters

in	*i*	current day in simulation–loop counter (julian date)
in	*j*	HRU number
in	*k*	
in	*sb*	subbasin number

5.249 volq.f90 File Reference

Functions/Subroutines

- subroutine volq (j)

  call subroutines to calculate the current day's CN for the HRU and to calculate surface runoff

5.249.1 Detailed Description

file containing the subroutine volq

Author

modified by Javier Burguete

5.249.2 Function/Subroutine Documentation

5.249.2.1 volq()

```
subroutine volq (
            integer, intent(in) j )
```

call subroutines to calculate the current day's CN for the HRU and to calculate surface runoff

Parameters

in	*j*	HRU number (none)

5.250 watbal.f90 File Reference

Functions/Subroutines

- subroutine watbal (j)

  this subroutine computes the daily water balance for each HRU changes in storage should equal water losses from the system write statements can be uncommented for model debugging. This subroutine will give errors for HRUs receiving irrigation water from reaches or reservoirs

5.250.1 Detailed Description

file containing the subroutine watbal

Author

modified by Javier Burguete

5.250.2 Function/Subroutine Documentation

5.250.2.1 watbal()

```
subroutine watbal (
            integer, intent(in) j )
```

this subroutine computes the daily water balance for each HRU changes in storage should equal water losses from the system write statements can be uncommented for model debugging. This subroutine will give errors for HRUs receiving irrigation water from reaches or reservoirs

Parameters

in	*j*	HRU number (none)

5.251 water_hru.f90 File Reference

Functions/Subroutines

- subroutine water_hru (j)

    this subroutine compute pet and et using Priestly-Taylor and a coefficient

5.251.1 Detailed Description

file containing the subroutine water_hru

Author

modified by Javier Burguete

5.251.2 Function/Subroutine Documentation

5.251.2.1 water_hru()

```
subroutine water_hru (
            integer, intent(in) j )
```

this subroutine compute pet and et using Priestly-Taylor and a coefficient

Parameters

in	*j*	HRU number

5.252 watqual.f90 File Reference

Functions/Subroutines

- subroutine watqual (i, jrch)

  this subroutine performs in-stream nutrient transformations and water quality calculations

5.252.1 Detailed Description

file containing the subroutine watqual

Author

modified by Javier Burguete

5.252.2 Function/Subroutine Documentation

5.252.2.1 watqual()

```
subroutine watqual (
            integer, intent(in) i,
            integer, intent(in) jrch )
```

this subroutine performs in-stream nutrient transformations and water quality calculations

Parameters

in	*i*	current day in simulation–loop counter (julian date)
in	*jrch*	reach number (none)

5.253 watqual2.f90 File Reference

Functions/Subroutines

- subroutine watqual2 (jrch)

  this subroutine performs in-stream nutrient transformations and water quality calculations

5.253.1 Detailed Description

file containing the subroutine watqual2

Author

adapted by Ann van Griensven, Belgium.
Modified by Javier Burguete

5.253.2 Function/Subroutine Documentation

5.253.2.1 watqual2()

```
subroutine watqual2 (
            integer, intent(in) jrch )
```

this subroutine performs in-stream nutrient transformations and water quality calculations

Parameters

in	*jrch*	reach number (none)

5.254 wattable.f90 File Reference

Functions/Subroutines

- subroutine wattable (j)
  this subroutine is the master soil percolation component. param[in] j HRU number

5.254.1 Detailed Description

file containing the subroutine wattable

Author

modified by Javier Burguete

5.255 watuse.f90 File Reference

Functions/Subroutines

- subroutine watuse (j)
  this subroutine removes water from appropriate source (pond, shallow aquifer, and/or deep aquifer) for consumptive water use

5.255.1 Detailed Description

file containing the subroutine watuse

Author

modified by Javier Burguete

5.255.2 Function/Subroutine Documentation

5.255.2.1 watuse()

```
subroutine watuse (
            integer, intent(in) j )
```

this subroutine removes water from appropriate source (pond, shallow aquifer, and/or deep aquifer) for consumptive water use

Parameters

in	*j*	HRU number (none)

5.256 weatgn.f90 File Reference

Functions/Subroutines

- subroutine weatgn (j)

  this subroutine generates weather parameters used to simulate the impact of precipitation on the other climatic processes

5.256.1 Detailed Description

file containing the subroutine weatgn

Author

modified by Javier Burguete

5.256.2 Function/Subroutine Documentation

5.256.2.1 weatgn()

```
subroutine weatgn (
            integer, intent(in) j )
```

this subroutine generates weather parameters used to simulate the impact of precipitation on the other climatic processes

Parameters

in	*j*	HRU number

5.257 wetlan.f90 File Reference

Functions/Subroutines

- subroutine wetlan (j)

  this subroutine simulates wetlands

5.257.1 Detailed Description

file containing the subroutine wetlan

Author

modified by Javier Burguete

5.257.2 Function/Subroutine Documentation

5.257.2.1 wetlan()

```
subroutine wetlan (
            integer, intent(in) j )
```

this subroutine simulates wetlands

Parameters

in	*j*	HRU number (none)

5.258 wmeas.f90 File Reference

Functions/Subroutines

- subroutine wmeas

  this subroutine reads in wind speed data from file and assigns the data to HRUs

5.258.1 Detailed Description

file containing the subroutine wmeas

Author

modified by Javier Burguete

5.259 wndgen.f90 File Reference

Functions/Subroutines

- subroutine wndgen (j)

    this subroutine generates wind speed

5.259.1 Detailed Description

file containing the subroutine wndgen

Author

modified by Javier Burguete

5.259.2 Function/Subroutine Documentation

5.259.2.1 wndgen()

```
subroutine wndgen (
            integer, intent(in) j )
```

this subroutine generates wind speed

Parameters

in	*j*	HRU number

5.260 writea.f90 File Reference

Functions/Subroutines

- subroutine writea (i)

    this subroutine writes annual output

5.260.1 Detailed Description

file containing the subroutine writea

Author

modified by Javier Burguete

5.260.2 Function/Subroutine Documentation

5.260.2.1 writea()

```
subroutine writea (
            integer, intent(in) i )
```

this subroutine writes annual output

Parameters

in	*i*	current day of simulation (julian date)

5.261 writed.f90 File Reference

Functions/Subroutines

- subroutine writed
  this subroutine contains the daily output writes

5.261.1 Detailed Description

file containing the subroutine writed

Author

modified by Javier Burguete

5.262 writem.f90 File Reference

Functions/Subroutines

- subroutine writem (i)
  this subroutine writes monthly output

5.262.1 Detailed Description

file containing the subroutine writem

Author

modified by Javier Burguete

5.262.2 Function/Subroutine Documentation

5.262.2.1 writem()

```
subroutine writem (
            integer, intent(in) i )
```

this subroutine writes monthly output

Parameters

in	*i*	current day of simulation (julian date)

5.263 xmon.f90 File Reference

Functions/Subroutines

- subroutine xmon
  this subroutine determines the month, given the julian date and leap year flag

5.263.1 Detailed Description

file containing the subroutine xmon

Author

modified by Javier Burguete

5.264 ysed.f90 File Reference

Functions/Subroutines

- subroutine ysed (iwave, j)
  this subroutine predicts daily soil loss caused by water erosion using the modified universal soil loss equation

5.264.1 Detailed Description

file containing the subroutine ysed

Author

modified by Javier Burguete

5.264.2 Function/Subroutine Documentation

5.264.2.1 ysed()

```
subroutine ysed (
            integer, intent(in) iwave,
            integer, intent(in) j )
```

this subroutine predicts daily soil loss caused by water erosion using the modified universal soil loss equation

Parameters

in	*iwave*	flag to differentiate calculation of HRU and subbasin sediment calculation (none) iwave = 0 for HRU iwave = subbasin # for subbasin
in	*j*	HRU number

5.265 zero0.f90 File Reference

Functions/Subroutines

- subroutine zero0

  this subroutine initializes the values for some of the arrays

5.265.1 Detailed Description

file containing the subroutine zero0

Author

modified by Javier Burguete

5.266 zero1.f90 File Reference

Functions/Subroutines

- subroutine zero1

  this subroutine initializes the values for some of the arrays

5.266.1 Detailed Description

file containing the subroutine zero1

Author

modified by Javier Burguete

5.267 zero2.f90 File Reference

Functions/Subroutines

- subroutine zero2
  this subroutine zeros all array values

5.267.1 Detailed Description

file containing the subroutine zero2

Author

modified by Javier Burguete

5.268 zero_urbn.f90 File Reference

Functions/Subroutines

- subroutine zero_urbn
  this subroutine zeros all array values used in urban modeling

5.268.1 Detailed Description

file containing the subroutine zero_urbn

Author

modified by Javier Burguete

5.269 zeroini.f90 File Reference

Functions/Subroutines

- subroutine zeroini
  this subroutine zeros values for single array variables

5.269.1 Detailed Description

file containing the subroutine zeroini

Author

modified by Javier Burguete

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