

SWAT

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<b>1 SWAT</b>	<b>1</b>
<b>2 Modules Index</b>	<b>7</b>
2.1 Modules List . . . . .	7
<b>3 Data Type Index</b>	<b>9</b>
3.1 Data Types List . . . . .	9
<b>4 File Index</b>	<b>11</b>
4.1 File List . . . . .	11
<b>5 Module Documentation</b>	<b>13</b>
5.1 parm Module Reference . . . . .	13
5.1.1 Detailed Description . . . . .	57
<b>6 Data Type Documentation</b>	<b>59</b>
6.1 parm::ascrv Interface Reference . . . . .	59
6.2 parm::atri Interface Reference . . . . .	59
6.3 parm::aunif Interface Reference . . . . .	59
6.4 parm::dstn1 Interface Reference . . . . .	60
6.5 parm::ee Interface Reference . . . . .	60
6.6 parm::expo Interface Reference . . . . .	60
6.7 parm::fsgd Interface Reference . . . . .	60
6.8 parm::HQDAV Interface Reference . . . . .	61
6.9 parm::layersplit Interface Reference . . . . .	61
6.10 parm::ndenit Interface Reference . . . . .	61
6.11 parm::qman Interface Reference . . . . .	61
6.12 parm::regres Interface Reference . . . . .	62
6.13 parm::rsedaa Interface Reference . . . . .	62
6.14 parm::tair Interface Reference . . . . .	62
6.15 parm::theta Interface Reference . . . . .	62
6.16 parm::vbl Interface Reference . . . . .	62
<b>7 File Documentation</b>	<b>63</b>
7.1 getallo.f90 File Reference . . . . .	63
7.1.1 Detailed Description . . . . .	63
7.2 main.f90 File Reference . . . . .	63
7.2.1 Detailed Description . . . . .	63
7.2.2 Function/Subroutine Documentation . . . . .	64
7.2.2.1 main() . . . . .	64
<b>Index</b>	<b>65</b>



# Chapter 1

## SWAT

An updated 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 `generate-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:)
- 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**):

```
$ doxygen
$ cd latex
$ make
```

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 `sfstedstdev<=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"`, `"rhdbbsb"`, `"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 `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`:
  - `"rhdbbsb"` could be used not initialized at line 84
- 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  $xx \leq 1.e-6$
- In pothole.f:
  - "solp\\_tileo" could be used not initialized at line 593 if  $pot\_vol(j) \leq 1.e-6$  or  $potvol\_tile \leq 1.e-6$
- 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\\_tnylida" 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  $hrtwtr(ii) / (idt*60) \leq 0.01$
- 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_urban.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:

<a href="#">parm</a>	Main module contatining the global variables . . . . .	<a href="#">13</a>
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## Chapter 3

# Data Type Index

### 3.1 Data Types List

Here are the data types with brief descriptions:

<a href="#">parm::ascrv</a>	59
<a href="#">parm::atri</a>	59
<a href="#">parm::aunif</a>	59
<a href="#">parm::dstn1</a>	60
<a href="#">parm::ee</a>	60
<a href="#">parm::expo</a>	60
<a href="#">parm::fcgd</a>	60
<a href="#">parm::HQDAV</a>	61
<a href="#">parm::layersplit</a>	61
<a href="#">parm::ndenit</a>	61
<a href="#">parm::qman</a>	61
<a href="#">parm::regres</a>	62
<a href="#">parm::rsedaa</a>	62
<a href="#">parm::tair</a>	62
<a href="#">parm::theta</a>	62
<a href="#">parm::vbl</a>	62



## Chapter 4

# File Index

### 4.1 File List

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

[getallo.f90](#)

This subroutine calculates the number of HRUs, subbasins, etc. in the simulation. These values are used to allocate array sizes . . . . .

[63](#)

[main.f90](#)

This is the main program that reads input, calls the main simulation model, and writes output .

[63](#)





## Chapter 5

# Module Documentation

### 5.1 parm Module Reference

main module containing the global variables

#### Data Types

- interface [ascrv](#)
- interface [atri](#)
- interface [aunif](#)
- interface [dstn1](#)
- interface [ee](#)
- interface [expo](#)
- interface [fcgd](#)
- interface [HQDAV](#)
- interface [layersplit](#)
- interface [ndenit](#)
- interface [qman](#)
- interface [regres](#)
- interface [rsedaa](#)
- interface [tair](#)
- interface [theta](#)
- interface [vbl](#)

#### Variables

- integer, parameter [mvaro](#) = 33  
*max number of variables routed through the reach*
- integer, parameter [mhruo](#) = 79  
*max number of variables in output.hru*
- integer, parameter [mrcho](#) = 62  
*max number of variables in reach file*
- integer, parameter [msub0](#) = 24  
*max number of variables in output.sub*
- integer, parameter [mstdo](#) = 113

*max number of variables summarized in output.std*

- integer, parameter **motot** = 600
- integer **icalen**
- real \*8 **prf\_bsn**
- real \*8 **co2\_x2**
- real \*8 **co2\_x**
- real \*8, dimension(:), allocatable **alph\_e**
- real \*8, dimension(:), allocatable **co\_p**
- real \*8, dimension(:), allocatable **surlag**
- real \*8, dimension(:), allocatable **cdn**
- real \*8, dimension(:), allocatable **nperco**
- real \*8, dimension(:), allocatable **cmn**
- real \*8, dimension(:), allocatable **phoskd**
- real \*8, dimension(:), allocatable **psp**
- real \*8, dimension(:), allocatable **sdnco**
- real \*8 **yield**
- real \*8 **burn\_frlb**
- real \*8 **pst\_kg**
- real \*8 **r2adj\_bsn**
- 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 **l\_k1**
- real \*8, dimension(:), allocatable **l\_k2**
- real \*8, dimension(:), allocatable **l\_lambda**
- real \*8, dimension(:), allocatable **l\_beta**
- real \*8, dimension(:), allocatable **l\_gama**
- real \*8, dimension(:), allocatable **l\_harea**
- real \*8, dimension(:), allocatable **l\_vleng**
- real \*8, dimension(:), allocatable **l\_vslope**
- real \*8, dimension(:), allocatable **l\_ktc**
- real \*8, dimension(:), allocatable **biofilm\_mumax**
- real \*8, dimension(:), allocatable **biofilm\_kinv**
- real \*8, dimension(:), allocatable **biofilm\_klw**
- real \*8, dimension(:), allocatable **biofilm\_kla**
- real \*8, dimension(:), allocatable **biofilm\_cdet**
- real \*8, dimension(:), allocatable **biofilm\_bm**
- 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 **iru**
- integer **mru**
- integer **irch**
- integer **isub**
- integer **idum**
- integer **mhyd\_bsn**
- integer **ipest**
- integer **ils\_nofig**
- integer **mhru1**
- integer, dimension(:), allocatable **mhyd1**
- integer, dimension(:), allocatable **irtun**
- 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**
- real \*8 **nfixmx**
- real \*8 **rsd\_covco**
- real \*8 **vcrit**
- real \*8 **res\_stlr\_co**
- real \*8 **wshd\_sw**
- real \*8 **wshd\_snob**
- real \*8 **wshd\_pndfr**
- real \*8 **wshd\_pndv**
- real \*8 **wshd\_pndsed**
- real \*8 **wshd\_wetfr**
- real \*8 **wshd\_resfr**
- real \*8 **wshd\_resha**
- real \*8 **wshd\_pndha**
- real \*8 **percop**
- real \*8 **wshd\_fminp**
- real \*8 **wshd\_ftotn**
- real \*8 **wshd\_fnh3**
- real \*8 **wshd\_fno3**
- real \*8 **wshd\_forgn**
- real \*8 **wshd\_forgp**
- real \*8 **wshd\_ftotp**
- real \*8 **wshd\_yldn**
- real \*8 **wshd\_yldp**
- real \*8 **wshd\_fixn**
- real \*8 **wshd\_pup**
- real \*8 **wshd\_wstrs**
- real \*8 **wshd\_nstrs**
- real \*8 **wshd\_pstrs**
- real \*8 **wshd\_tstrs**
- real \*8 **wshd\_astrs**
- real \*8 **wshd\_hmn**
- real \*8 **wshd\_rwn**
- real \*8 **wshd\_hmp**

- real \*8 **wshd\_rmn**
- real \*8 **wshd\_dnit**
- real \*8 **ffcb**
- real \*8 **wshd\_rmp**
- real \*8 **wshd\_voln**
- real \*8 **wshd\_nitn**
- real \*8 **wshd\_pas**
- real \*8 **wshd\_pal**
- real \*8 **wdpq**
- real \*8 **wshd\_plch**
- real \*8 **wshd\_raino3**
- real \*8 **ressedc**
- real \*8 **basno3f**
- real \*8 **basorgnf**
- real \*8 **wof\_p**
- real \*8 **wshd\_pinlet**
- real \*8 **wshd\_ptile**
- real \*8 **basminpf**
- real \*8 **basorgpf**
- real \*8 **sftmp**
- real \*8 **smtmp**
- real \*8 **smfmx**
- real \*8 **smfmn**
- real \*8 **wgpq**
- real \*8 **wshd\_resv**
- real \*8 **wshd\_ressed**
- real \*8 **basno3i**
- real \*8 **basorgni**
- real \*8 **basminpi**
- real \*8 **wdlpq**
- real \*8 **basorgpi**
- real \*8 **peakr**
- real \*8 **pndsedin**
- real \*8 **sw\_excess**
- real \*8 **albday**
- real \*8 **wglpq**
- real \*8 **wdps**
- real \*8 **wtabelo**
- real \*8 **timp**
- real \*8 **tilep**
- real \*8 **wt\_shall**
- real \*8 **sq\_rto**
- real \*8 **tloss**
- real \*8 **inflpcp**
- real \*8 **snomlt**
- real \*8 **snofall**
- real \*8 **fixn**
- real \*8 **qtile**
- real \*8 **crk**
- real \*8 **latlyr**
- real \*8 **pndloss**
- real \*8 **wetloss**
- real \*8 **potloss**
- real \*8 **lpndloss**
- real \*8 **lwetloss**

- real \*8 **sedrch**
- real \*8 **fertn**
- real \*8 **sol\_rd**
- real \*8 **cfertn**
- real \*8 **cfertp**
- real \*8 **sepday**
- real \*8 **bioday**
- real \*8 **sepcrk**
- real \*8 **sepcrktot**
- real \*8 **fertno3**
- real \*8 **fertnh3**
- real \*8 **fertorgn**
- real \*8 **fertsolp**
- real \*8 **fertorgp**
- real \*8 **fertp**
- real \*8 **grazn**
- real \*8 **grazp**
- real \*8 **soxy**
- real \*8 **qdfr**
- real \*8 **sdti**
- real \*8 **rtwtr**
- real \*8 **ressa**
- real \*8 **wgps**
- real \*8 **rttime**
- real \*8 **rchdep**
- real \*8 **rtevp**
- real \*8 **rttlc**
- real \*8 **da\_km**
- real \*8 **resflwi**
- real \*8 **wdlps**
- real \*8 **wglps**
- real \*8 **resflwo**
- real \*8 **respcp**
- real \*8 **resev**
- real \*8 **ressep**
- real \*8 **ressedi**
- real \*8 **ressedo**
- real \*8 **dtot**
- real \*8 **wdprch**
- real \*8 **nperco\_bsn**
- real \*8 **pperco\_bsn**
- real \*8 **rsdco**
- real \*8 **phoskd\_bsn**
- real \*8 **voltot**
- real \*8 **volcrmin**
- real \*8 **msk\_x**
- real \*8 **uno3d**
- real \*8 **canev**
- real \*8 **usle**
- real \*8 **rcn**
- real \*8 **surlag\_bsn**
- real \*8 **bactkdq**
- real \*8 **precipday**
- real \*8 **wdpf**
- real \*8 **thbact**

- real \*8 **wpq20**
- real \*8 **wlpq20**
- real \*8 **wps20**
- real \*8 **wlps20**
- real \*8 **bactrop**
- real \*8 **bactsedp**
- real \*8 **bactlchp**
- real \*8 **bactlchlp**
- real \*8 **enratio**
- real \*8 **wetpcp**
- real \*8 **pndpcp**
- real \*8 **wetsep**
- real \*8 **wgpf**
- real \*8 **pndsep**
- real \*8 **wetev**
- real \*8 **pndev**
- real \*8 **pndsedo**
- real \*8 **wetsedo**
- real \*8 **pndflwi**
- real \*8 **wetflwi**
- real \*8 **pndflwo**
- real \*8 **wetflwo**
- real \*8 **wetsedi**
- real \*8 **da\_ha**
- real \*8 **vpd**
- real \*8 **bactrolp**
- real \*8 **bactsedlp**
- real \*8 **evrch**
- real \*8 **evlai**
- real \*8 **pet\_day**
- real \*8 **ep\_day**
- real \*8 **wdlpf**
- real \*8 **snoev**
- real \*8 **sno3up**
- real \*8 **adj\_pkr**
- real \*8 **n\_updis**
- real \*8 **p\_updis**
- real \*8 **nactfr**
- real \*8 **reactw**
- real \*8 **sdiegropq**
- real \*8 **sdiegrolpq**
- real \*8 **sdiegrops**
- real \*8 **sdiegrolps**
- real \*8 **es\_day**
- real \*8 **sbactrop**
- real \*8 **sbactrolp**
- real \*8 **sbactsedp**
- real \*8 **sbactsedlp**
- real \*8 **ep\_max**
- real \*8 **wof\_lp**
- real \*8 **sbactlchp**
- real \*8 **sbactlchlp**
- real \*8 **psp\_bsn**
- real \*8 **rchwtr**
- real \*8 **resuspst**

- real \*8 **setlpst**
- real \*8 **bsprev**
- real \*8 **bssprev**
- real \*8 **spadyo**
- real \*8 **spadyev**
- real \*8 **spadysp**
- real \*8 **spadyrfv**
- real \*8 **spadyosp**
- real \*8 **qday**
- real \*8 **usle\_ei**
- real \*8 **ai5**
- real \*8 **pndsedc**
- real \*8 **no3pcp**
- real \*8 **rcharea**
- real \*8 **volatpst**
- real \*8 **wetsedc**
- real \*8 **uobw**
- real \*8 **ubw**
- real \*8 **uobn**
- real \*8 **uobp**
- real \*8 **respesti**
- real \*8 **wglpf**
- real \*8 **snocovmx**
- real \*8 **snocov1**
- real \*8 **snocov2**
- real \*8 **rexp**
- real \*8 **rcor**
- real \*8 **lyrtile**
- real \*8 **lyrtilex**
- real \*8 **ai0**
- real \*8 **ai1**
- real \*8 **ai2**
- real \*8 **ai3**
- real \*8 **ai4**
- real \*8 **ai5**
- real \*8 **ai6**
- real \*8 **rhoq**
- real \*8 **tfact**
- real \*8 **sno50cov**
- real \*8 **mumax**
- real \*8 **lambda0**
- real \*8 **lambda1**
- real \*8 **lambda2**
- real \*8 **k\_l**
- real \*8 **k\_n**
- real \*8 **k\_p**
- real \*8 **p\_n**
- real \*8 **rnum1**
- real \*8 **autop**
- real \*8 **auton**
- real \*8 **etday**
- real \*8 **hmntl**
- real \*8 **rwntl**
- real \*8 **hmptl**
- real \*8 **rmn2tl**

- real \*8 **rmptl**
- real \*8 **wdntl**
- real \*8 **cmn\_bsn**
- real \*8 **rmptl**
- real \*8 **roctl**
- real \*8 **gwseep**
- real \*8 **revapday**
- real \*8 **reswtr**
- real \*8 **bury**
- real \*8 **difus**
- real \*8 **reactb**
- real \*8 **solpesto**
- real \*8 **petmeas**
- real \*8 **wdlprch**
- real \*8 **wdpres**
- real \*8 **sorpesto**
- real \*8 **spcon\_bsn**
- real \*8 **spexp\_bsn**
- real \*8 **solpesti**
- real \*8 **sorpesti**
- real \*8 **wdlpres**
- real \*8 **snoprev**
- real \*8 **swprev**
- real \*8 **shallstp**
- real \*8 **deepstp**
- real \*8 **msk\_co1**
- real \*8 **msk\_co2**
- real \*8 **ressolpo**
- real \*8 **resorgno**
- real \*8 **resorgpo**
- real \*8 **resno3o**
- real \*8 **reschlao**
- real \*8 **resno2o**
- real \*8 **resnh3o**
- real \*8 **qdbank**
- real \*8 **potpcpmm**
- real \*8 **potevmm**
- real \*8 **potsepmm**
- real \*8 **potflwo**
- real \*8 **potsedo**
- real \*8 **pest\_sol**
- real \*8 **trnsrch**
- real \*8 **wp20p\_plt**
- real \*8 **bactminp**
- real \*8 **bactminlp**
- real \*8 **wp20lp\_plt**
- real \*8 **cncoef**
- real \*8 **cdn\_bsn**
- real \*8 **sdnco\_bsn**
- real \*8 **bact\_swf**
- real \*8 **bactmx**
- real \*8 **bactmin**
- real \*8 **chla\_subco**
- real \*8 **tb\_adj**
- real \*8 **cn\_froz**



- real \*8 **dorm\_hr**
- real \*8 **smxco**
- real \*8 **depimp\_bsn**
- real \*8 **ddrain\_bsn**
- real \*8 **tdrain\_bsn**
- 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**
- real \*8 **ch\_opco\_bsn**
- real \*8 **ch\_onco\_bsn**
- real \*8 **bc1\_bsn**
- real \*8 **bc2\_bsn**
- real \*8 **bc3\_bsn**
- real \*8 **bc4\_bsn**
- real \*8 **rcn\_sub\_bsn**
- real \*8 **decr\_min**
- real \*8 **anion\_excl\_bsn**
- real \*8, dimension(:), allocatable **wat\_tbl**
- real \*8, dimension(:), allocatable **sol\_swpwt**
- real \*8, dimension(:,:), allocatable **vwt**
- real \*8 **re\_bsn**
- real \*8 **sdrain\_bsn**
- real \*8 **sstmaxd\_bsn**
- real \*8 **drain\_co\_bsn**
- real \*8 **pc\_bsn**
- real \*8 **latksatf\_bsn**
- integer **i\_subhw**
- integer **imgt**
- integer **idlast**
- integer **iwtr**
- integer **ifrttyp**
- integer **mo\_atmo**
- integer **mo\_atmo1**
- integer **ifirstatmo**
- integer **iy\_r\_atmo**
- integer **iy\_r\_atmo1**
- integer **matmo**
- integer **mch**  
*maximum number of channels*
- integer **mcr**  
*maximum number of crops grown per year*
- integer **mcrdb**  
*max number of lu/lc defined in crop.dat*
- integer **mfcast**  
*maximum number of forecast stations*
- integer **mfdb**  
*max number of fertilizers in fert.dat*
- integer **mhru**  
*maximum number of HRUs in watershed*

- integer **mhyd**  
*maximum number of hydrograph nodes*
- integer **mpdb**  
*max number of pesticides in pest.dat*
- integer **mrg**  
*max number of rainfall/temp gages*
- integer **mcut**  
*maximum number of cuttings per year*
- integer **mgr**  
*maximum number of grazings per year*
- integer **mnr**  
*max number of years of rotation*
- integer **myr**  
*max number of years of simulation*
- integer **isubwq**
- integer **ffcst**
- integer **isproj**  
*special project code: 1 test rewind (run simulation twice)*
- integer **nhru**
- integer **mo**
- integer **nbyr**
- integer **immo**
- integer **nrch**
- integer **nres**
- integer **irte**
- integer **i\_mo**
- integer **icode**
- integer **ihout**
- integer **inum1**
- integer **inum2**
- integer **inum3**
- integer **inum4**
- integer **wndsim**
- integer **ihru**
- integer **inum5**
- integer **inum6**
- integer **inum7**
- integer **inum8**
- integer **icfac**
- integer **mrech**  
*maximum number of rechour files*
- integer **nrgage**  
*number of raingage files*
- integer **nrgfil**  
*number of rain gages per file*
- integer **nrtot**  
*total number of rain gages*
- integer **ntgage**  
*number of temperature gage files*
- integer **ntgfil**  
*number of temperature gages per file*
- integer **nttot**

*total number of temperature gages*

- integer **lao**
- integer **igropt**
- integer **npmx**
- integer **irtpest**
- integer **curyr**
- integer **tmsim**
- integer **icrk**
- integer **iihru**
- integer **ismax**
- integer **itdrn**
- integer **iwt dn**
- integer **iroutunit**
- integer **ires\_nut**
- integer **iclb**

*auto-calibration flag*

- integer **mrecc**

*maximum number of recnst 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**
- integer **mrecy**

*maximum number of recyear files*

- integer **ipet**
- integer **nyskip**
- integer **ideg**
- integer **ievent**
- integer **slrsim**
- integer **iopera**
- integer **id1**
- integer **idaf**
- integer **idal**
- integer **leapyr**
- integer **mo\_chk**
- integer **rhsim**
- integer **nhtot**

*number of relative humidity records in file*

- integer **nstot**

*number of solar radiation records in file*

- integer **nwtot**

*number of wind speed records in file*

- integer **ifirsts**
- integer **ifirsth**
- integer **ifirstw**
- integer **icst**
- integer **ilog**
- integer **i**

- integer **iy**r
- integer **itot**r
- integer **iw**q
- integer **isk**ip
- integer **ifirst**pet
- integer **itot**b
- integer **itot**s
- integer **ip**rp
- integer **pcpsim**
- integer **itot**h
- integer **nd\_30**
- integer **iop**s
- integer **ip**hr
- integer **ist**o
- 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**
- 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**
- integer **iprint**
- integer **iida**
- integer **fcstcnt**
- integer **icn**
- integer **ised\_det**
- integer **mtran**
- integer **id**till
- integer, dimension(100) **ida\_lup**
- integer, dimension(100) **iy**r\_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 yyymmdd, 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=80) **prog**

*SWAT program header string.*

- character(len=13) **slrfile**
- character(len=13) **wndfile**
- character(len=13) **rhfile**
- character(len=13) **petfile**
- character(len=13) **calfile**
- 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**
- integer, dimension(:), allocatable **ifistr**
- 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**
- integer, dimension(13) **ndays\_noleap**
- integer, dimension(13) **ndays\_leap**
- 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**

*index target of cover defined at planting*

- real \*8, dimension(:), allocatable **bio\_targ**
- real \*8, dimension(:), allocatable **tnyld**
- 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**
- integer **iseptic**
- real \*8, dimension(:), allocatable **sptqs**

- real \*8, dimension(:), allocatable **percp**
- real \*8, dimension(:), allocatable **sptbodconcs**
- real \*8, dimension(:), allocatable **spttssconcs**
- real \*8, dimension(:), allocatable **spttnconcs**
- real \*8, dimension(:), allocatable **sptnh4concs**
- real \*8, dimension(:), allocatable **sptno3concs**
- real \*8, dimension(:), allocatable **sptno2concs**
- real \*8, dimension(:), allocatable **sptorgnconcs**
- real \*8, dimension(:), allocatable **spttpconcs**
- real \*8, dimension(:), allocatable **sptminps**
- real \*8, dimension(:), allocatable **sptorgps**
- real \*8, dimension(:), allocatable **sptfcolis**
- real \*8, dimension(:), allocatable **failyr**
- real \*8, dimension(:), allocatable **qstemm**
- real \*8, dimension(:), allocatable **bio\_amn**
- real \*8, dimension(:), allocatable **bio\_bod**
- real \*8, dimension(:), allocatable **biom**
- real \*8, dimension(:), allocatable **rbiom**
- real \*8, dimension(:), allocatable **fcoli**
- real \*8, dimension(:), allocatable **bio\_ntr**
- real \*8, dimension(:), allocatable **bz\_perc**
- real \*8, dimension(:), allocatable **plqm**
- real \*8, dimension(:), allocatable **sep\_cap**
- real \*8, dimension(:), allocatable **bz\_area**
- real \*8, dimension(:), allocatable **bz\_z**
- real \*8, dimension(:), allocatable **bz\_thk**
- real \*8, dimension(:), allocatable **bio\_bd**
- real \*8, dimension(:), allocatable **cmup\_kgh**
- real \*8, dimension(:), allocatable **cmtot\_kgh**
- real \*8, dimension(:), allocatable **coeff\_bod\_dc**
- real \*8, dimension(:), allocatable **coeff\_bod\_conv**
- real \*8, dimension(:), allocatable **coeff\_fc1**
- real \*8, dimension(:), allocatable **coeff\_fc2**
- real \*8, dimension(:), allocatable **coeff\_fecal**
- real \*8, dimension(:), allocatable **coeff\_plq**
- real \*8, dimension(:), allocatable **coeff\_mrt**
- real \*8, dimension(:), allocatable **coeff\_rsp**
- real \*8, dimension(:), allocatable **coeff\_slg1**
- real \*8, dimension(:), allocatable **coeff\_slg2**
- real \*8, dimension(:), allocatable **coeff\_nitr**
- real \*8, dimension(:), allocatable **coeff\_denitr**
- real \*8, dimension(:), allocatable **coeff\_pdistrb**
- real \*8, dimension(:), allocatable **coeff\_solpslp**
- real \*8, dimension(:), allocatable **coeff\_solpintc**
- real \*8, dimension(:), allocatable **coeff\_psortpmax**
- integer, dimension(:), allocatable **i\_sep**
- integer, dimension(:), allocatable **isep\_typ**
- integer, dimension(:), allocatable **isep\_opt**
- 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**
- real \*8, dimension(:), allocatable **pot\_solpi**
- real \*8, dimension(:), allocatable **pot\_orgp**
- real \*8, dimension(:), allocatable **pot\_orgpi**
- real \*8, dimension(:), allocatable **pot\_orgn**
- real \*8, dimension(:), allocatable **pot\_orgni**
- real \*8, dimension(:), allocatable **pot\_mps**
- real \*8, dimension(:), allocatable **pot\_mpsi**
- real \*8, dimension(:), allocatable **pot\_mpa**
- 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(41) **icolrsv**
- integer, dimension([mhruo](#)) **icols**
- integer, dimension([mrcho](#)) **icolr**
- integer, dimension([msubo](#)) **icolb**
- integer, dimension(46) **ipdvar**
- integer, dimension([mhruo](#)) **ipdvas**
- integer, dimension([msubo](#)) **ipdvab**
- integer, dimension(:), allocatable **ipdhru**
- real \*8, dimension([mstdo](#)) **wshddayo**
- real \*8, dimension([mstdo](#)) **wshdmono**
- real \*8, dimension([mstdo](#)) **wshdyro**
- real \*8, dimension(16) **fcstaa**
- real \*8, dimension([mstdo](#)) **wshdaao**
- real \*8, dimension(:,:), allocatable **wpstdayo**
- real \*8, dimension(:,:), allocatable **wpstmono**
- real \*8, dimension(:,:), allocatable **wpstyro**
- real \*8, dimension(:,:), allocatable **yldkg**
- real \*8, dimension(:,:), allocatable **bio\_hv**
- real \*8, dimension(:,:), allocatable **wpstaa**
- real \*8, dimension(:,:), allocatable **rchmono**

- real \*8, dimension(:,:), allocatable **rchyro**
- real \*8, dimension(:,:), allocatable **rchaao**
- real \*8, dimension(:,:), allocatable **rchdy**
- real \*8, dimension(:,:), allocatable **hrumono**
- real \*8, dimension(:,:), allocatable **hruyro**
- real \*8, dimension(:,:), allocatable **hruaao**
- real \*8, dimension(:,:), allocatable **submono**
- real \*8, dimension(:,:), allocatable **subyro**
- real \*8, dimension(:,:), allocatable **subaao**
- real \*8, dimension(:,:), allocatable **resoutm**
- real \*8, dimension(:,:), allocatable **resouty**
- real \*8, dimension(:,:), allocatable **resouta**
- real \*8, dimension(12, 8) **wshd\_aamon**
- real \*8, dimension(:,:), allocatable **wtrmon**
- real \*8, dimension(:,:), allocatable **wtryr**
- real \*8, dimension(:,:), allocatable **wtraa**
- real \*8, dimension(:,:), allocatable **sub\_smfmx**
- real \*8, dimension(:,:), allocatable **sub\_smfmn**
- real \*8, dimension(:,:), allocatable **hrupstd**
- real \*8, dimension(:,:), allocatable **hrupsta**
- real \*8, dimension(:,:), allocatable **hrupstm**
- real \*8, dimension(:,:), allocatable **hrupsty**
- integer, dimension(:), allocatable **ifirstt**
- integer, dimension(:), allocatable **ifirstpcp**
- integer, dimension(:), allocatable **elevp**
- integer, dimension(:), allocatable **elevt**
- real \*8, dimension(:,:), allocatable **ftmpstdmn**
- real \*8, dimension(:,:), allocatable **ftmpmn**
- real \*8, dimension(:,:), allocatable **ftmpmx**
- real \*8, dimension(:,:), allocatable **ftmpstdmx**
- real \*8, dimension(:,:), allocatable **fpr\_w**
- real \*8, dimension(:,:), allocatable **fpcp\_stat**
- real \*8, dimension(:), allocatable **flwin**
- real \*8, dimension(:), allocatable **flwout**
- real \*8, dimension(:), allocatable **bankst**
- real \*8, dimension(:), allocatable **ch\_wi**
- real \*8, dimension(:), allocatable **ch\_d**
- real \*8, dimension(:), allocatable **ch\_onco**
- real \*8, dimension(:), allocatable **ch\_opco**
- real \*8, dimension(:), allocatable **ch\_orgn**
- real \*8, dimension(:), allocatable **ch\_orgp**
- real \*8, dimension(:), allocatable **drift**
- real \*8, dimension(:), allocatable **rch\_dox**
- real \*8, dimension(:), allocatable **rch\_bactp**
- real \*8, dimension(:), allocatable **alpha\_bnk**
- real \*8, dimension(:), allocatable **alpha\_bnke**
- real \*8, dimension(:), allocatable **disolvp**
- real \*8, dimension(:), allocatable **algae**
- real \*8, dimension(:), allocatable **sedst**
- real \*8, dimension(:), allocatable **rchstor**
- real \*8, dimension(:), allocatable **organicn**
- real \*8, dimension(:), allocatable **organicp**
- real \*8, dimension(:), allocatable **chlora**
- real \*8, dimension(:), allocatable **nitratn**
- real \*8, dimension(:), allocatable **nitriten**



- real \*8, dimension(:), allocatable **ch\_li**
- real \*8, dimension(:), allocatable **ch\_si**
- 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 **depprch**
- real \*8, dimension(:), allocatable **depprfp**
- real \*8, dimension(:), allocatable **prf**
- real \*8, dimension(:), allocatable **r2adj**
- real \*8, dimension(:), allocatable **spcon**
- real \*8, dimension(:), allocatable **spexp**
- 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**
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- flag for types of pesticide used in watershed array location is pesticide ID number*  
*0: pesticide not used*  
*1: pesticide used*
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*max number of time steps per day*

- integer **idt**

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- integer **iuh**
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- real \*8 **rill\_mult**
- real \*8 **eros\_expo**
- real \*8 **sedprev**
- real \*8 **c\_factor**
- real \*8 **sig\_g**
- real \*8 **ch\_d50**
- real \*8 **uhalpha**
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- real \*8 **abstmax**
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- real \*8, dimension(:,:), allocatable **gr\_dummy1**
- real \*8, dimension(:,:), allocatable **gr\_dummy2**
- real \*8, dimension(:,:), allocatable **gr\_dummy3**
- real \*8, dimension(:,:), allocatable **gr\_dummy4**
- real \*8, dimension(:,:), allocatable **gr\_dummy5**
- 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**
- real \*8, dimension(:,:), allocatable **rg\_dummy1**
- real \*8, dimension(:,:), allocatable **rg\_dummy2**
- real \*8, dimension(:,:), allocatable **rg\_dummy3**
- real \*8, dimension(:,:), allocatable **rg\_dummy4**
- real \*8, dimension(:,:), allocatable **rg\_dummy5**
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- 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**
- real \*8, dimension(:,:), allocatable **cs\_dummy1**
- real \*8, dimension(:,:), allocatable **cs\_dummy2**
- real \*8, dimension(:,:), allocatable **cs\_dummy3**
- real \*8, dimension(:,:), allocatable **cs\_dummy4**
- real \*8, dimension(:,:), allocatable **cs\_dummy5**
- 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**
- real \*8, dimension(:,:), allocatable **pv\_dummy1**
- real \*8, dimension(:,:), allocatable **pv\_dummy2**
- real \*8, dimension(:,:), allocatable **pv\_dummy3**
- real \*8, dimension(:,:), allocatable **pv\_dummy4**
- real \*8, dimension(:,:), allocatable **pv\_dummy5**
- integer, dimension(:,:), allocatable **lid\_onoff**
- real \*8, dimension(:,:), allocatable **sol\_bmc**
- real \*8, dimension(:,:), allocatable **sol\_bmn**
- real \*8, dimension(:,:), allocatable **sol\_hsc**
- real \*8, dimension(:,:), allocatable **sol\_hsn**
- real \*8, dimension(:,:), allocatable **sol\_hpc**
- real \*8, dimension(:,:), allocatable **sol\_hpn**
- real \*8, dimension(:,:), allocatable **sol\_lm**
- real \*8, dimension(:,:), allocatable **sol\_lmc**
- real \*8, dimension(:,:), allocatable **sol\_lmn**
- real \*8, dimension(:,:), allocatable **sol\_ls**
- real \*8, dimension(:,:), allocatable **sol\_lsl**
- real \*8, dimension(:,:), allocatable **sol\_lsc**
- real \*8, dimension(:,:), allocatable **sol\_lsn**
- 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**
- 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\_rsd\_c\_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 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**

### 5.1.1 Detailed Description

main module containing the global variables

Author

modified by Javier Burguete Tolosa



## Chapter 6

# Data Type Documentation

### 6.1 `parm::ascrv` Interface Reference

#### Public Member Functions

- subroutine **ascrv** (`x1`, `x2`, `x3`, `x4`, `x5`, `x6`)

The documentation for this interface was generated from the following file:

- `modparm.f90`

### 6.2 `parm::atri` Interface Reference

#### Public Member Functions

- real \*8 function **atri** (`at1`, `at2`, `at3`, `at4i`)

The documentation for this interface was generated from the following file:

- `modparm.f90`

### 6.3 `parm::aunif` Interface Reference

#### Public Member Functions

- real \*8 function **aunif** (`x1`)

The documentation for this interface was generated from the following file:

- `modparm.f90`

## 6.4 parm::dstn1 Interface Reference

### Public Member Functions

- real \*8 function **dstn1** (rn1, rn2)

The documentation for this interface was generated from the following file:

- modparm.f90

## 6.5 parm::ee Interface Reference

### Public Member Functions

- real \*8 function **ee** (tk)

The documentation for this interface was generated from the following file:

- modparm.f90

## 6.6 parm::expo Interface Reference

### Public Member Functions

- real \*8 function **expo** (xx)

The documentation for this interface was generated from the following file:

- modparm.f90

## 6.7 parm::fcgd Interface Reference

### Public Member Functions

- real \*8 function **fcgd** (xx)

The documentation for this interface was generated from the following file:

- modparm.f90



## 6.8 parm::HQDAV Interface Reference

### Public Member Functions

- subroutine **hqdav** (A, CBW, QQ, SSS, ZCH, ZX, CHW, FPW, jrch)

The documentation for this interface was generated from the following file:

- modparm.f90

## 6.9 parm::layersplit Interface Reference

### Public Member Functions

- subroutine **layersplit** (dep\_new)

The documentation for this interface was generated from the following file:

- modparm.f90

## 6.10 parm::ndenit Interface Reference

### Public Member Functions

- subroutine **ndenit** (k, j, cdg, wdn, void)

The documentation for this interface was generated from the following file:

- modparm.f90

## 6.11 parm::qman Interface Reference

### Public Member Functions

- real \*8 function **qman** (x1, x2, x3, x4)

The documentation for this interface was generated from the following file:

- modparm.f90

## 6.12 parm::regres Interface Reference

### Public Member Functions

- real \*8 function **regres** (k)

The documentation for this interface was generated from the following file:

- modparm.f90

## 6.13 parm::rsedaa Interface Reference

### Public Member Functions

- subroutine **rsedaa** (years)

The documentation for this interface was generated from the following file:

- modparm.f90

## 6.14 parm::tair Interface Reference

### Public Member Functions

- real \*8 function **tair** (hr, jj)

The documentation for this interface was generated from the following file:

- modparm.f90

## 6.15 parm::theta Interface Reference

### Public Member Functions

- real \*8 function **theta** (r20, thk, tmp)

The documentation for this interface was generated from the following file:

- modparm.f90

## 6.16 parm::vbl Interface Reference

### Public Member Functions

- subroutine **vbl** (evx, spx, pp, qin, ox, vx1, vy, yi, yo, ysx, vf, vyf, aha)

The documentation for this interface was generated from the following file:

- modparm.f90

## Chapter 7

# File Documentation

### 7.1 getallo.f90 File Reference

This subroutine calculates the number of HRUs, subbasins, etc. in the simulation. These values are used to allocate array sizes.

#### Functions/Subroutines

- subroutine **getallo**

#### 7.1.1 Detailed Description

This subroutine calculates the number of HRUs, subbasins, etc. in the simulation. These values are used to allocate array sizes.

Author

modified by Javier Burguete

### 7.2 main.f90 File Reference

this is the main program that reads input, calls the main simulation model, and writes output.

#### Functions/Subroutines

- program **main**

*this is the main program that reads input, calls the main simulation model, and writes output.*

#### 7.2.1 Detailed Description

this is the main program that reads input, calls the main simulation model, and writes output.

## 7.2.2 Function/Subroutine Documentation

### 7.2.2.1 main()

```
program main ( )
```

this is the main program that reads input, calls the main simulation model, and writes output.

#### Author

modified by Javier Burguete Tolosa

# Index

getallo.f90, [63](#)

main

main.f90, [64](#)

main.f90, [63](#)

main, [64](#)

parm, [13](#)

parm::ascrv, [59](#)

parm::atri, [59](#)

parm::aunif, [59](#)

parm::dstn1, [60](#)

parm::ee, [60](#)

parm::expo, [60](#)

parm::fcgd, [60](#)

parm::HQDAV, [61](#)

parm::layersplit, [61](#)

parm::ndenit, [61](#)

parm::qman, [61](#)

parm::regres, [62](#)

parm::rsedaa, [62](#)

parm::tair, [62](#)

parm::theta, [62](#)

parm::vbl, [62](#)