CHAPTER 2

SWAT INPUT DATA: WATERSHED CONFIGURATION

The first step in setting up a watershed simulation is to define the relative arrangement of the parts or elements, i.e. the configuration, of the watershed. If the watershed has only one primary channel and there is little variation in topography and climate across the watershed, there may not be a need to partition the watershed into smaller units. However, the majority of watersheds will exhibit enough complexity in the stream network, topography or climate to warrant subdivision for modeling purposes.

There are several techniques used to discretize a watershed. In the past, models could only apply one type of discretization scheme to a watershed. This

resulted in the development of several models that differ only in the watershed discretization scheme used.

2.1 DISCRETIZATION SCHEMES

The three most common techniques used to discretize a watershed are:

- Grid cell. This configuration allows the user to incorporate significant spatial detail into a simulation. Models which use this technique include AGNPS (Young et al., 1987), ANSWERS (Beasley et al., 1980) and the WEPP grid version (Foster, 1987).
- Representative hillslope. This configuration is useful for modeling hillslope processes. This technique is used in APEX (Williams, et al., 1998) and the WEPP hillslope version (Lane and Nearing, 1989).
- Subwatershed. This configuration preserves the natural channels and flow paths of the watershed. This technique is used in the WEPP watershed version (Foster, 1987), HYMO (Williams and Hann, 1973) and SWRRB (Arnold et al., 1990).

All of these schemes have strengths, weaknesses and applications for which they are most appropriate. SWAT uses the subwatershed configuration as the primary discretization scheme for a watershed. However, because of the routing command language utilized in SWAT, it is possible to use any of these three, alone or in combination, to model a watershed.

2.2 WATERSHED CONFIGURATION FILE (.FIG)

The watershed configuration file contains information used by SWAT to simulate processes occurring within the HRU/subbasin and to route the stream loadings through the channel network of the watershed. A reach routing command structure, similar to that developed for HYMO (Williams and Hann, 1973), is utilized to route and add flows through the watershed. The following sections review the different features of the watershed configuration file.

2.2.1 INCORPORATION OF COMMENTS

To assist the user in interpreting the watershed configuration file, an unlimited number of comment lines are allowed. These comments can be used to isolate the routing commands for different reaches, etc. To included comments in the watershed configuration file, a line must have an asterisk (*) in the 1st space on the line. When SWAT reads the asterisk, it will skip to the next line.

2.2.2 COMMAND LINES

Fifteen different commands may be used in the watershed configuration file. The commands, along with their numeric codes, are:

finish	0
subbasin	1
route	2
routres	3
transfer	4
add	5
rechour	6
recmon	7
recyear	8
save	9
recday	10
reccnst	11
structure	12
apex	13
saveconc	14
autocal	16

The format of the commands is illustrated in Figure 2-1.

The most commonly used commands are: subbasin, route, add, and finish. These commands simulate the land phase of the hydrologic cycle and determine the loadings to the main channel (subbasin), model the movement and transformations occurring in the main channel (route), allow the output from different subbasins to be summed together (add), and identify the end of the routing command sequence (finish).

The remaining commands are utilized to model more unique configurations. This set of commands can be divided into several subgroups: routing of water through a reservoir (routres), humanly contrived movement of

water (transfer), aeration of water resulting from flow through structures along the channel (structure), incorporation of point source data (rechour, recday, recmon, recyear, reccnst), formatting of watershed outflow for input into a different SWAT simulation (save), formatting of water quality simulation results at specified points in the reach network (saveconc), and identification of auto-calibration points in the watershed (autocal).

The watershed configuration file is a fixed format file. With fixed format, the model looks for data only in a particular location on a command line. Spaces not allocated to variable inputs for a specific command are not processed by the model. The interfaces commonly use the extra space to write other data or they insert zeros in the unused columns. Appendix B steps through the set up of example watershed configuration files and will be very helpful to users trying to familiarize themselves with the logic of this file.

Watershed Configuration: SWAT 2012

Command formats:

	icode	ihout	inum1	inum2	inum3	rnum1	inum4
	column 1	**column 2**	**column 3**	**column 4**	**column 5**	**column 6**	**column 7**
	space 11-16	space 17-22	space 23-28	space 29-34	space 35-40	space 41-46	space 47-55
subbasin	1	HYD_STOR	SUB_NUM				GIS_CODE
	SUBFILE						
route	2	HYD_STOR	RCH_NUM	HYD_NUM		FLOW_OVN	
	RTEFILE		SWQFILE				
routres	3	HYD_STOR	RES_NUM	HYD_NUM			
	RESFILE		LWQFILE				
transfer	4	DEP_TYPE	DEP_NUM	DEST_TYPE	DEST_NUM	TRANS_AMT	TRANS_CODE
add	5	HYD_STOR	HYD_NUM1	HYD_NUM2			
rechour	6	HYD_STOR	FILEHR_NUM				
	FILE_HR						
recmon	7	HYD_STOR	FILEMON_NUM			DRAINAGE_AREA	
	FILE_MON						
recyear	8	HYD_STOR	FILEYR_NUM			DRAINAGE_AREA	
	FILE_YEAR						
save	9	HYD_NUM	FILEMASS_NUM	PRINT_FREQ	PRINT_FMT		
	FILE_MASS						
recday	10	HYD_STOR	FILEDAY_NUM			DRAINAGE_AREA	
	FILE_DAY						
reccnst	11	HYD_STOR	FILECNST_NUM			DRAINAGE_AREA	
	FILE_CNST						
structur	12	HYD_STOR	HYD_NUM			AERATION_COEF	
	13						
saveconc	14	HYD_NUM	FILECONC_NUM	PRINT_FREQ			
	FILE_CONC						
	15						
autocal	16	HYD_NUM	FILECAL_NUM	PRINT_FREQ			
	FILE_ACAL						
finish	0						

Figure 2-1: Commands included in watershed configuration file

2.2.2.1 FINISH COMMAND (0)

The last command line in the .fig file must be a finish command line. The finish command notifies the model that the end of the command lines in the watershed configuration file has been reached. Variables required on the finish command line are:

Variable name	Definition
COMMAND	The command code = 0 for the finish command. Required.

The format of the finish command line is:

Variable name	Position	Format	F90 Format
COMMAND	space 11-16	6-digit integer	i6

2.2.2.2 SUBBASIN COMMAND (1)

The subbasin command simulates all processes involved in the land phase of the hydrologic cycle and computes runoff, sediment, and chemical loadings from each HRU within the subbasin. The subbasin command requires 2 lines. Variables required on the subbasin command lines are:

Variable name	Definition
COMMAND	The command code = 1 for the subbasin command. Required.
HYD_STOR	The hydrograph storage location number. After a command is executed, the results are stored in an array at the position defined by this number. It is crucial that all hydrograph storage location numbers are unique. If the same number is used twice, output from one command line will be overwritten by that from another and simulation results will be incorrect. Required.
SUB_NUM	Subbasin number. Every subbasin in the watershed has a different number. Required.
GIS_CODE	GIS code printed to output files. Optional.
SUBFILE	Name of subbasin general input data file (.sub). This file contains parameters for the subbasin which are reviewed in Chapter 5. Required.

The format of the subbasin command lines is:

Variable name	Line #	Position	Format	F90 Format
COMMAND	1	space 11-16	6-digit integer	i6
HYD_STOR	1	space 17-22	6-digit integer	i6
SUB_NUM	1	space 23-28	6-digit integer	i6
GIS_CODE	1	space 47-55	9-digit integer	i9
SUBFILE	2	space 11-23	character	a13

2.2.2.3 ROUTE COMMAND (2)

The route command routes the water, sediment, and chemical loadings through a main channel or reach. The route command requires two lines. Variables required on the route command lines are:

Variable name	Definition
COMMAND	The command code = 2 for the route command. Required.
HYD_STOR	The hydrograph storage location number. After a command is executed, the results are stored in an array at the position defined by this number. It is crucial that all hydrograph storage location numbers are unique. If the same number is used twice, output from one command line will be overwritten by that from another and simulation results will be incorrect. Required.
RCH_NUM	Reach number. The reach number is the same as the number of the subbasin in which the reach is located. Required.
HYD_NUM	Inflow hydrograph storage location number. The storage location containing the data to be routed through the reach. Required.
FLOW_OVN	Fraction of overland flow (0.000 to 1.000). If flow leaving a subbasin is completely channelized, FLOW_OVN = 0.000. In cases where a hillslope is being simulated, overland flow from one subbasin to another occurs and the value of FLOW_OVN can be increased to account for the amount of non-channelized overland flow taking place between the subbasins. The overland flow to the next subbasin is added to the rainfall of the receiving subbasin and allowed to infiltrate or run off. The sediment and chemical loadings associated with the overland flow are assumed to be deposited on the upper soil layer of the receiving subbasin. The fraction of the flow in the channel is routed directly to the reach of the receiving subbasin. Required.

Variable name	Definition
RTEFILE	Name of routing input data file (.rte). This file contains parameters for the main channel which are reviewed in Chapter 25. Required.
SWQFILE	Name of stream water quality data file (.swq). This file contains parameters for water quality simulation in the reach which are reviewed in Chapter 27. Required.

The format of the route command lines is:

Variable name	Line #	Position	Format	F90 Format
COMMAND	1	space 11-16	6-digit integer	i6
HYD_STOR	1	space 17-22	6-digit integer	i6
RCH_NUM	1	space 23-28	6-digit integer	i6
HYD_NUM	1	space 29-34	6-digit integer	i6
FLOW_OVN	1	space 41-46	decimal (xx.xxx)	f6.3
RTEFILE	2	space 11-23	character	a13
SWQFILE	2	space 24-36	character	a13

2.2.2.4 ROUTRES COMMAND (3)

The routres command routes water, sediment, and chemical loadings through a reservoir. The routres command requires two lines. Variables required on the routres command lines are:

Variable name	Definition
COMMAND	The command code = 3 for the routres command. Required.
HYD_STOR	The hydrograph storage location number for results. Required.
RES_NUM	Reservoir number. Each reservoir modeled in the watershed must be assigned a unique consecutive number beginning at 1. Required.
HYD_NUM	Inflow hydrograph storage location number. The storage location of the data to be routed through the reservoir. Required.
RESFILE	Name of reservoir input file (.res). This file contains parameters for the reservoir which are reviewed in Chapter 29. Required.
LWQFILE	Name of reservoir water quality input file (.lwq). This file contains parameters to model water quality in the reservoir which are reviewed in Chapter 30. Optional.

The format of the routres command lines is:

Variable name	Line #	Position	Format	F90 Format
COMMAND	1	space 11-16	6-digit integer	i6
HYD_STOR	1	space 17-22	6-digit integer	i6
RES_NUM	1	space 23-28	6-digit integer	i6
HYD_NUM	1	space 29-34	6-digit integer	i6
RESFILE	2	space 11-23	character	a13
LWQFILE	2	space 24-36	character	a13

2.2.2.5 TRANSFER COMMAND (4)

While water is most typically removed from a water body for irrigation purposes, SWAT also allows water to be transferred from one water body to another. This is performed with a transfer command in the watershed configuration file.

The transfer command can be used to move water from any reservoir or reach in the watershed to any other reservoir or reach in the watershed. The user must input the type of water source, the location of the source, the type of water body receiving the transfer, the location of the receiving water body, and the amount of water transferred.

Three options are provided to specify the amount of water transferred: a fraction of the volume of water in the source; a volume of water left in the source; or the volume of water transferred. The transfer is performed every day of the simulation.

Originally, the transfer command was the only method available to irrigate an HRU. While the irrigation scenarios are now handled primarily in the management files, the transfer command was retained for flexibility. This command should not be used with hourly stream routing. Variables required on the transfer command line are:

Variable name	Definition
COMMAND	The command code = 4 for the transfer command. Required.
DEP_TYPE	Water source type: 1 reach 2 reservoir Required.
DEP_NUM	Water source number. The number of the reach or reservoir from which the flow will be diverted. Required.

Variable name	Definition
DEST_TYPE	Destination type. Defines the receiving body. 1 reach 2 reservoir Required.
DEST_NUM	Destination number. Number of reach or reservoir receiving the water. Required.
TRANS_AMT	The flow amount transferred. (defined by TRANS_CODE). Required.
TRANS_CODE	The rule code governing the transfer of water: 1 A fraction of the flow or volume to be transferred out of the reach or reservoir is specified 2 A minimum flow (reach) or volume (reservoir) to leave in the reach or reservoir is specified (m^3/sec) 3 An exact amount of water to be transferred is specified (m^3/sec) Required.
TRANS_SE	Sequential transfer command number
MO_TRANSB	Month to begin transfer
MO_TRANSE	Month to end transfer
IH_TRANS	Hydrograph source number

The format of the transfer command line is:

Variable name	Line	Position	Format	F90 Format
COMMAND	1	space 11-16	6-digit integer	i6
DEP_TYPE	1	space 17-22	6-digit integer	i6
DEP_NUM	1	space 23-28	6-digit integer	i6
DEST_TYPE	1	space 29-34	6-digit integer	i6
DEST_NUM	1	space 35-40	6-digit integer	i6
TRANS_AMT	1	space 41-46	decimal (xx.xxx)	f6.3
TRANS_CODE	1	space 47-55	9-digit integer	i9
TRANS_SE	1	space 56-58	3-digit integer	i3
MO_TRANSB	2	space 11-14	4-digit integer	i4
MO_TRANSE	2	space 15-18	4-digit integer	i4
IH_TRANS	2	space 19-22	4-digit integer	i4

2.2.2.6 ADD COMMAND (5)

The add command is used to sum the water, sediment, and chemical loadings of any two hydrographs. Variables required on the add command line are:

Variable name	Definition
COMMAND	The command code = 5 for the add command. Required.
HYD_STOR	The hydrograph storage location number to hold the results. Required.
HYD_NUM1	The hydrograph storage location number of the 1st set of data to be added. Required.
HYD_NUM2	The hydrograph storage location number of the 2nd set of data to be added. Required.

The format of the add command line is:

Variable name	Position	Format	F90 Format
COMMAND	space 11-16	6-digit integer	i6
HYD_STOR	space 17-22	6-digit integer	i6
HYD_NUM1	space 23-28	6-digit integer	i6
HYD_NUM2	space 29-34	6-digit integer	i6

2.2.2.7 RECHOUR COMMAND (6)

The rechour command is one of five routing commands that reads in flow, sediment and chemical loading records from a file for routing through the watershed. This command is useful for reading in point source data or data from simulations of upstream areas. The rechour command is used to read in data summarized on an hourly basis. The rechour command requires two lines. Variables required on the rechour command lines are:

Variable name	Definition
COMMAND	The command code = 6 for the rechour command. Required.
HYD_STOR	The hydrograph storage location number for the records. Required.
FILEHR_NUM	The file number. Unique file numbers should be used for each rechour command. Required.
DRAINAGE_AREA	Drainage area associated with records (km^2). Optional.
FILE_HR	Name of file containing hourly records. Parameters included in the file are reviewed in Chapter 31. Required.

The format of the rechour command lines is:

Variable name	Line #	Position	Format	F90 Format
COMMAND	1	space 11-16	6-digit integer	i6
HYD_STOR	1	space 17-22	6-digit integer	i6
FILEHR_NUM	1	space 23-28	6-digit integer	i6
DRAINAGE_AREA	1	space 41-46	decimal (xx.xxx)	f6.3
FILE_HR	2	space 11-23	character	a13

2.2.2.8 RECMON COMMAND (7)

The recmon command is one of five routing commands that reads in flow, sediment and chemical loading records from a file for routing through the watershed. The recmon command is used to read in data summarized by month. The recmon command requires two lines. Variables required on the recmon command lines are:

Variable name	Definition
COMMAND	The command code = 7 for the recmon command. Required.
HYD_STOR	The hydrograph storage location number for the records. Required.
FILEMON_NUM	The file number. Unique file numbers should be used for each recmon command. Required.
DRAINAGE_AREA	Drainage area associated with records (km^2). Optional.
FILE_MON	Name of the file containing the monthly records. Parameters included in the file are reviewed in Chapter 31. Required.

The format of the recmon command lines is:

Variable name	Line #	Position	Format	F90 Format
COMMAND	1	space 11-16	6-digit integer	i6
HYD_STOR	1	space 17-22	6-digit integer	i6
FILEMON_NUM	1	space 23-28	6-digit integer	i6
DRAINAGE_AREA	1	space 41-46	decimal (xx.xxx)	f6.3
FILE_MON	2	space 11-23	character	a13

2.2.2.9 RECYEAR COMMAND (8)

The recyear command is one of five routing commands that reads in flow, sediment and chemical loading records from a file for routing through the watershed. The recyear command is used to read in annual output. The recyear command requires two lines. Variables required on the recyear command lines are:

Variable name	Definition
COMMAND	The command code = 8 for the recyear command. Required.
HYD_STOR	The hydrograph storage location number for the records. Required.
FILEYR_NUM	The file number. Unique file numbers should be used for each recyear command. Required.
DRAINAGE_AREA	Drainage area associated with records (km^2). Optional.
FILE_YR	Name of file containing annual records. Parameters included in the file are reviewed in Chapter 31. Required.

The format of the recyear command lines is:

Variable name	Line #	Position	Format	F90 Format
COMMAND	1	space 11-16	6-digit integer	i6
HYD_STOR	1	space 17-22	6-digit integer	i6
FILEYR_NUM	1	space 23-28	6-digit integer	i6
DRAINAGE_AREA	1	space 41-46	decimal(xx.xxx)	f6.3
FILE_YR	2	space 11-23	character	a13

2.2.2.10 SAVE COMMAND (9)

The save command allows the user to print daily SWAT output to the output file specified. This output file can then be read into another SWAT run using the recday command. Up to 10 save commands are allowed in a given watershed configuration file. Variables required on the save command line are:

Variable name	Definition
COMMAND	The command code = 9 for save command. Required.
HYD_NUM	The hydrograph storage location number of the data to be printed to file. Required.
FILESAVE_NUM	The file number. Unique file numbers should be used for each save command. Required.
PRINT_FREQ	Printing frequency. For simulations using a sub-daily time step, water quality information may be summarized and printed for every hour or every day. Simulations using a daily time step will always print daily average values. 0 report daily averages 1 report hourly averages The default printing frequency is to print daily averages. Required.
PRINT_FMT	Printing format. This variable allows users to output data in two different formats. 0 SWAT code format 1 SWAT/ArcView Interface format If the SWAT/ArcView Interface is being used to set up datasets, this variable will format the output from the save command to be imported by the interface. Required.
FILE_MASS	Name of file to which the water quality information is written. Required.

The format of the save command line is:

Variable name	Line #	Position	Format	F90 Format
COMMAND	1	space 11-16	6-digit integer	i6
HYD_NUM	1	space 17-22	6-digit integer	i6
FILESAVE_NUM	1	space 23-28	6-digit integer	i6
PRINT_FREQ	1	space 29-34	6-digit integer	i6
PRINT_FMT	1	space 35-40	6-digit integer	i6
FILE_MASS	2	space 11-23	character	a13

2.2.2.11 RECDAY COMMAND (10)

The recday command is one of five routing commands that reads in flow, sediment and chemical loading records from a file for routing through the watershed. This command is useful for reading in point source data or data from simulations of upstream areas. The recday command is used to read in data summarized on a daily basis. The recday command requires two lines. Variables required on the recday command lines are:

Variable name	Definition
COMMAND	The command code = 10 for the recday command. Required.
HYD_STOR	The hydrograph storage location number for the records. Required.
FILEDAY_NUM	The file number. Unique file numbers should be used for each recday command. Required.
DRAINAGE_AREA	Drainage area associated with records (km^2). Optional.
FILE_DAY	Name of file containing daily records. Parameters in this file are reviewed in Chapter 31. Required.

The format of the recday command lines is:

Variable name	Line #	Position	Format	F90 Format
COMMAND	1	space 11-16	6-digit integer	i6
HYD_STOR	1	space 17-22	6-digit integer	i6
FILEDAY_NUM	1	space 23-28	6-digit integer	i6
DRAINAGE_AREA	1	space 41-46	decimal (xx.xxx)	f6.3
FILE_DAY	2	space 11-23	character	a13

2.2.2.12 RECCNST COMMAND (11)

The reccnst command is one of five routing commands that reads in flow, sediment and chemical loading records from a file for routing through the watershed. This command is useful for reading in point source data. The reccnst command is used to read in average annual data. The reccnst command requires two lines. Variables required on the reccnst command lines are:

Variable name	Definition
COMMAND	The command code = 11 for the reccnst command. Required.
HYD_STOR	The hydrograph storage location number for the records. Required.
FILECNST_NUM	The file number. Unique file numbers should be used for each reccnst command. Required.
DRAINAGE_AREA	Drainage area associated with records (km^2). Optional.
FILE_CNST	Name of file containing average annual records. Parameters in this file are reviewed in Chapter 31. Required.

The format of the reccnst command lines is:

Variable name	Line #	Position	Format	F90 Format
COMMAND	1	space 11-16	6-digit integer	i6
HYD_STOR	1	space 17-22	6-digit integer	i6
FILECNST_NUM	1	space 23-28	6-digit integer	i6
DRAINAGE_AREA	1	space 41-46	decimal(xx.xxx)	f6.3
FILE_CNST	2	space 11-23	character	a13

2.2.2.13 STRUCTURE COMMAND (12)

The structure command simulates aeration caused by the tumbling of water as it moves over weirs or other structures along the stream network. In highly polluted streams, the aeration of the stream by this method is a significant source of oxygen. The structure command alters the dissolved oxygen content based on the aeration coefficient input by the user. Variables required on the structure command line are:

Variable name	Definition
COMMAND	The command code = 12 for the structure command. Required.
HYD_STOR	The hydrograph storage location number for results. Required.
HYD_NUM	Inflow hydrograph storage location number. The data that is to be adjusted to reflect aeration. (Dissolved oxygen content is the only value that is altered with this command.) Required.
AERATION_COEF	Aeration coefficient. Butts and Evans (1983) documents the following relationship that can be used to estimate the reaeration coefficient: $rea = 1 + 0.38 \cdot coef_a \cdot coef_b \cdot h_{fall} \cdot \left(1 - 0.11 \cdot h_{fall}\right) \cdot \left(1 + 0.046 \cdot \overline{T}_{water}\right)$ where *rea* is the reaeration coefficient, $coef_a$ is an empirical water quality factor, $coef_b$ is an empirical dam aeration coefficient, h_{fall} is the height through which water falls (m), and $\overline{T}_{water}$ is the average water temperature (°C).

Variable name	Definition
AERATION_COEF, cont.	The empirical water quality factor is assigned a value based on the condition of the stream: $coef_a$ = 1.80 in clean water $coef_a$ = 1.60 in slightly polluted water $coef_a$ = 1.00 in moderately polluted water $coef_a$ = 1.00 in moderately polluted water $coef_a$ = 0.65 in grossly polluted water The empirical dam aeration coefficient is assigned a value based on the type of structure: $coef_b$ = 0.70 to 0.90 for flat broad crested weir $coef_b$ = 1.05 for sharp crested weir with straight slope face $coef_b$ = 0.80 for sharp crested weir with vertical face $coef_b$ = 0.05 for sluice gates with submerged discharge Required.

The format of the structure command is:

Variable name	Position	Format	F90 Format
COMMAND	space 11-16	6-digit integer	i6
HYD_STOR	space 17-22	6-digit integer	i6
HYD_NUM	space 23-28	6-digit integer	i6
AERATION_COEF	space 41-46	decimal (xx.xxx)	f6.3

2.2.2.14 APEX COMMAND (13)

The apex command allows the model to read from a daily APEX output file.

The apex command requires two lines. Variables required on the apex command lines are:

Variable name	Definition
COMMAND	The command code = 13 for the apex command. Required.
HYD_STOR	The hydrograph storage location number of the data get from the subbasin command. Required.
FILECONC_NUM	The file number. Unique file numbers should be used for each APEX command. Required.
APEX_IN	Name of APEX output file to be read into SWAT. Required.

The format of the apex command lines is:

Variable name	Line #	Position	Format	F90 Format
COMMAND	1	space 11-16	6-digit integer	i6
HYD_STOR	1	space 17-22	6-digit integer	i6
FILECONC_NUM	1	space 23-28	6-digit integer	i6
APEX_IN	2	space 11-23	character	a13

2.2.2.15 SAVECONC COMMAND (14)

The saveconc command saves flow, sediment and water quality indicator information from a specified point on the reach network to a file. The water quality information is reported as concentrations. This command is useful for isolating reach information at a particular point on the channel network. Up to 50 saveconc commands can be specified in the watershed configuration file.

The saveconc command requires two lines. Variables required on the saveconc command lines are:

Variable name	Definition
COMMAND	The command code = 14 for the saveconc command. Required.
HYD_NUM	The hydrograph storage location number of the data to be printed to file. Required.
FILECONC_NUM	The file number. Unique file numbers should be used for each saveconc command. Required.
PRINT_FREQ	Printing frequency. For simulations using a sub-daily time step, water quality information may be summarized and printed for every hour or every day. Simulations using a daily time step will always print daily average values. 0 report daily averages 1 report hourly averages If no printing frequency is specified, the model will print daily averages. Required.
FILE_CONC	Name of file to which the water quality information is written. Required.

The format of the saveconc command lines is:

Variable name	Line #	Position	Format	F90 Format
COMMAND	1	space 11-16	6-digit integer	i6
HYD_NUM	1	space 17-22	6-digit integer	i6
FILECONC_NUM	1	space 23-28	6-digit integer	i6
PRINT_FREQ	1	space 29-34	6-digit integer	i6
FILE_CONC	2	space 11-23	character	a13

2.2.2.16 AUTOCAL COMMAND (16)

The autocal command identifies the location on the stream network that will be targeted in the automated method (calibration/sensitivity analysis). Measured data used to calibrate the simulation must be provided in the file specified in this command. Up to 10 autocal commands can be specified in a watershed configuration file.

The autocal command requires two lines. Variables required on the autocal command lines are:

Variable name	Definition
COMMAND	The command code = 16 for the autocal command. Required.
HYD_NUM	The hydrograph storage location number of the simulated data to be used in the calibration process. Required.
FILECAL_NUM	The file number. Unique file numbers should be used for each autocal command. Required.
PRINT_FREQ	Printing frequency. For simulations using a sub-daily time step, measured data to be used in the calibration process may be summarized on an hourly or daily basis. Simulations using a daily time step will always require daily measured data. 0 measured data summarized on a daily basis 1 measured data summarized on an hourly basis Required.
FILE_ACAL	Name of file containing the measured data to be used to calibrate the dataset at the specified point. Required.

The format of the autocal command lines is:

Variable name	Line #	Position	Format	F90 Format
COMMAND	1	space 11-16	6-digit integer	i6
HYD_NUM	1	space 17-22	6-digit integer	i6
FILECAL_NUM	1	space 23-28	6-digit integer	i6
PRINT_FREQ	1	space 29-34	6-digit integer	i6
FILE_ACAL	2	space 11-23	character	a13

2.2.2.17 ROUTE UNIT COMMAND (17)

The route unit command develops outputs for each routing unit and stores the output in varoute for further routing across the landscape and through rivers and reservoirs. The route unit command requires 2 lines. Variables required on the route command lines are:

Variable name	Definition
COMMAND	The command code = 17 for the route unit landscape command. Required.
HYD_STOR	The hydrograph storage location number. After a command is executed, the results are stored in an array at the position defined by this number. It is crucial that all hydrograph storage location numbers are unique. If the same number is used twice, output from one command line will be overwritten by that from another and simulation results will be incorrect. Required.
RU_NUM	Routing unit number. The routing unit number is sequential for each subbasin. In other words, it starts over at 1 for each subbasin. Required.
SUB_NUM	Subbasin number. The subbasin containing the routing unit. Required.
DARU_KM	Drainage area of routing unit (km^2). Required.
RUFILE	Name of routing unit data file. This file contains parameters for the routing unit and hru fractions which are reviewed in Chapter 41 (?). Required.

The format of the routunit command lines is:

Variable name	Line #	Position	Format	F90 Format
COMMAND	1	space 11-16	6-digit integer	i6
HYD_STOR	1	space 17-22	6-digit integer	i6
RU_NUM	1	space 23-28	6-digit integer	i6
SUB_NUM	1	space 29-34	6-digit integer	i6
RU_FILE	2	space 11-23	character	a13

2.2.2.18 ROUTE LANDSCAPE COMMAND (18)

The route landscape command simulates all processes involved in routing, runoff, sediment, and chemical loadings across a landscape unit. Surface runoff, lateral soil flow, groundwater flow and tile flow can all be routed independently across a landscape unit. Surface runoff and tile flow are routed across the soil surface, lateral soil flow is added to the soil profiles, and groundwater flow is added to recharge the following day. The route landscape command requires 1 line. Variables required on the subbasin command lines are:

Variable name	Definition
COMMAND	The command code = 18 for the route landscape command. Required.
HYD_STOR	The hydrograph storage location number. After a command is executed, the results are stored in an array at the position defined by this number. It is crucial that all hydrograph storage location numbers are unique. If the same number is used twice, output from one command line will be overwritten by that from another and simulation results will be incorrect. Required.
LU_NUM	Landscape (or routing unit) number. The landscape (or routing unit) and chemicals are routed through. Required.
HYD_NUM	Inflow hydrograph storage location number. The storage location containing the data to be routed through the reach. Required.
SUB_NUM	Subbasin number. The subbasin containing the landscape unit. Required.
SURQ_RCO	Surface runoff routing code. If SURQ_RCO=0 then route surface runoff across the landscape unit. Required.
LATQ_RCO	Lateral flow routing code. If LATQ_RCO=0 then route surface runoff across the landscape unit. Required.
GWQ_RCO	Groundwater flow routing code. If GWQ_RCO = 0 then route surface runoff across the landscape unit. Required.
TILEQ_RCO	Tile flow routing code. If TILEQ_RCO=1 then route surface runoff across the landscape unit. Required.

The format of the route landscape command lines is:

Variable name	Line #	Position	Format	F90 Format
COMMAND	1	space 11-16	6-digit integer	i6
HYD_STOR	1	space 17-22	6-digit integer	i6
LU_NUM	1	space 23-28	6-digit integer	i6
HYD_NUM	1	space 29-34	6-digit integer	i6
SUB_NUM	1	space 35-40	6-digit integer	i6
SURQ-RCO	1	space 41-46	6-digit integer	i6
LATQ_RCO	1	space 46-51	6-digit integer	i6
GWQ_RCO	1	space 52-57	6-digit integer	i6
TILEQ_RCO	1	space 58-63	6-digit integer	i6

2.3 REFERENCES

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