CHAPTER 6

SWAT INPUT DATA: .PCP

SWAT requires daily precipitation. Values for precipitation may be read from records of observed data or they may be generated. This chapter describes the format of the file used to read in measured precipitation data.

Up to 18 precipitation files may be utilized in a simulation. The precipitation files are able to hold records for more than one gage, so there is not a limitation on the number of gages that can be used in a simulation.

The precipitation data may be read into the model in daily or sub-daily time increments. The following sections describe the format for a daily and a subdaily precipitation file.

6.1 DAILY PRECIPITATION DATA

Daily precipitation data is used when the SCS curve number method is chosen to model surface runoff (Set by IEVENT in the .bsn file, see Chapter 4).

While the input file must contain data for the entire period of simulation, the record does not have to begin with the first day of simulation. SWAT is able to search for the beginning date in the file, saving editing time on the user's part. Once SWAT locates the record for the beginning day of simulation, it no longer processes the year and date. Because it does not check the subsequent dates, it is very important that the data for the remaining days in the simulation are listed sequentially. (If no year and date are entered for any of the records, the model assumes the first line of data corresponds to the first day of simulation.)

Following is a brief description of the variables in the precipitation input file. They are listed in the order they appear within the file.

Variable name	Definition
TITLE	The first line of the precipitation file is reserved for comments. The title line is not processed by the model and may be left blank.
	Optional.
LATITUDE	Latitude of precipitation recording gage location.
	This value is not used by the model and may be left blank.
	Optional.
LONGITUDE	Longitude of precipitation recording gage location.
	This value is not used by the model and may be left blank.
	Optional.
ELEVATION	Elevation of precipitation recording gage (m).
	The elevation of the recording gage is used to adjust precipitation values for elevation in subbasins where elevation bands and a precipitation lapse rate are defined.
	Required if elevation bands are modeled in watershed.
YEAR	Year (4-digit).
	Required.

Variable name	Definition
DATE	Julian date.
	Required.
PRECIPITATION	Amount of precipitation falling during the day (mm).
	A negative 99.0 (-99.0) should be inserted for missing data. This value tells SWAT to generate precipitation for that day.
	Required.

The format of the daily precipitation file with one record is:

Variable name	Line #	Position	Format	F90 Format
TITLE	1	unrestricted	character	unrestricted
LATITUDE	2	space 8-12	free	unrestricted
LONGITUDE	3	space 8-12	free	unrestricted
ELEVATION	4	space 8-12	integer	i5
YEAR	5-END	space 1-4	integer	i4
DATE	5-END	space 5-7	integer	i3
PRECIPITATION	5-END	space 8-12	decimal(xxx.x)	f5.1

To place more than one data record within the .pcp file, repeat the original formatting for the recorded data to the right of the existing data. Simulations have been run with 300 records placed in the precipitation files.

For example, assume there are records for six different rain gages stored in the daily .pcp. The formatting of the .pcp file is

Gage	Variable name	Line #	Position	Format	F90 Format
ALL	TITLE	1	unrestricted	character	unrestricted
1	LATITUDE	2	space 8-12	free	unrestricted
2	LATITUDE	2	space 13-17	free	unrestricted
3	LATITUDE	2	space 18-22	free	unrestricted
4	LATITUDE	2	space 23-27	free	unrestricted
5	LATITUDE	2	space 28-32	free	unrestricted
6	LATITUDE	2	space 33-37	free	unrestricted
1	LONGITUDE	3	space 8-12	free	unrestricted
2	LONGITUDE	3	space 13-17	free	unrestricted

Gage	Variable name	Line #	Position	Format	F90 Format
3	LONGITUDE	3	space 18-22	free	unrestricted
4	LONGITUDE	3	space 23-27	free	unrestricted
5	LONGITUDE	3	space 28-32	free	unrestricted
6	LONGITUDE	3	space 33-37	free	unrestricted
1	ELEVATION	4	space 8-12	integer	i5
2	ELEVATION	4	space 13-17	integer	i5
3	ELEVATION	4	space 18-22	integer	i5
4	ELEVATION	4	space 23-27	integer	i5
5	ELEVATION	4	space 28-32	integer	i5
6	ELEVATION	4	space 33-37	integer	i5
ALL	YEAR	5-END	space 1-4	4-digit integer	i4
ALL	DATE	5-END	space 5-7	3-digit integer	i3
1	PRECIPITATION	5-END	space 8-12	decimal(xxx.x)	f5.1
2	PRECIPITATION	5-END	space 13-17	decimal(xxx.x)	f5.1
3	PRECIPITATION	5-END	space 18-22	decimal(xxx.x)	f5.1
4	PRECIPITATION	5-END	space 23-27	decimal(xxx.x)	f5.1
5	PRECIPITATION	5-END	space 28-32	decimal(xxx.x)	f5.1
6	PRECIPITATION	5-END	space 33-37	decimal(xxx.x)	f5.1

6.2 SUB-DAILY PRECIPITATION DATA

Sub-daily precipitation data is required if the Green & Ampt infiltration method is being used (Set by IEVENT in the .bsn file, see Chapter 4).

While the input file must contain data for the entire period of simulation, the record does not have to begin with the first day of simulation. SWAT is able to search for the beginning date in the file, saving editing time on the user's part. Unlike the daily precipitation data, SWAT verifies that the date is correct on all lines. If the model reads in an incorrect date, it will print an error message to the *input.std* file stating the day and year in the precipitation record where the inconsistency is located and the program will stop.

The number of lines of precipitation data per day is governed by the time step used (IDT in file.cio, see Chapter 3). To save space, only one line is required for days with no rain at all. When SWAT reads a blank for the delimiter (see

variable list below), it knows that all time steps on the day have no precipitation and that there are no more lines of precipitation data for that day.

Following is a brief description of the variables in the sub-daily precipitation input file. They are listed in the order they appear within the file.

Variable name	Definition
TITLE	The first line of the precipitation file is reserved for comments. The title line is not processed by the model and may be left blank.
	Optional.
LATITUDE	Latitude of precipitation recording gage location.
	This value is not used by the model and may be left blank.
	Optional.
LONGITUDE	Longitude of precipitation recording gage location.
	This value is not used by the model and may be left blank.
	Optional.
ELEVATION	Elevation of precipitation recording gage (m).
	The elevation of the recording gage is used to adjust precipitation values for elevation in subbasins where elevation bands and a precipitation lapse rate are defined.
	Required if elevation bands modeled in watershed.
YEAR	Year (4-digit).
	Required.
DATE	Julian date.
	Required.
HOUR	Hour of day (0-23).
	The hour and minute are at the end of the time step.
	Required.
DELIMITER	Space is allowed on the line for a colon to separate the hour and minute readings. The delimiter is used by the model to identify days where there is no rain and only one line is present for the day in the .pcp file. If a blank space is inserted instead of the colon, the model will assign zero precipitation to all time steps on the day.
	Required.

Variable name	Definition
MINUTE	Minute of hour (0-59).
	The hour and minute are at the end of the time step.
	Required.
PRECIPITATION	Amount of precipitation falling in the time period (mm).
	A negative 99.0 (-99.0) should be inserted for missing data. This value tells SWAT to generate precipitation for that day. Precipitation values will be generated for the entire day. If the record for a given day has missing values for only part of the day, all provided values are ignored and the weather generator sets values for the entire day.
	Required.

The format of the sub-daily precipitation file with one record is:

Variable name	Line #	Position	Format	F90 Format
TITLE	1	unrestricted	character	unrestricted
LATITUDE	2	space 13-17	free	unrestricted
LONGITUDE	3	space 13-17	free	unrestricted
ELEVATION	4	space 13-17	integer	i5
YEAR	5-END	space 1-4	integer	i4
DATE	5-END	space 5-7	integer	i3
HOUR	5-END	space 8-9	integer	i2
DELIMITER	5-END	space 10	character	a1
MINUTE	5-END	space 11-12	integer	i2
PRECIPITATION	5-END	space 13-17	decimal(xxx.x)	f5.1

To place more than one data record within the .pcp file, repeat the original formatting for the recorded data to the right of the existing data. Simulations have been run with 200 records placed in the precipitation files.

For example, assume there are records for six different rain gages stored in the sub-daily .pcp. The formatting of the .pcp file is

Gage	Variable name	Line #	Position	Format	F90 Format
ALL	TITLE	1	unrestricted	character	unrestricted
1	LATITUDE	2	space 13-17	free	unrestricted
2	LATITUDE	2	space 18-22	free	unrestricted

Gage	Variable name	Line #	Position	Format	F90 Format
3	LATITUDE	2	space 23-27	free	unrestricted
4	LATITUDE	2	space 28-32	free	unrestricted
5	LATITUDE	2	space 33-37	free	unrestricted
6	LATITUDE	2	space 38-42	free	unrestricted
1	LONGITUDE	3	space 13-17	free	unrestricted
2	LONGITUDE	3	space 18-22	free	unrestricted
3	LONGITUDE	3	space 23-27	free	unrestricted
4	LONGITUDE	3	space 28-32	free	unrestricted
5	LONGITUDE	3	space 33-37	free	unrestricted
6	LONGITUDE	3	space 38-42	free	unrestricted
1	ELEVATION	4	space 13-17	integer	i5
2	ELEVATION	4	space 18-22	integer	i5
3	ELEVATION	4	space 23-27	integer	i5
4	ELEVATION	4	space 28-32	integer	i5
5	ELEVATION	4	space 33-37	integer	i5
6	ELEVATION	4	space 38-42	integer	i5
ALL	YEAR	5-END	space 1-4	4-digit integer	i4
ALL	DATE	5-END	space 5-7	3-digit integer	i3
ALL	HOUR	5-END	space 8-9	integer	i2
ALL	DELIMITER	5-END	space 10	character	a1
ALL	MINUTE	5-END	space 11-12	integer	i2
1	PRECIPITATION	5-END	space 13-17	decimal(xxx.x)	f5.1
2	PRECIPITATION	5-END	space 18-22	decimal(xxx.x)	f5.1
3	PRECIPITATION	5-END	space 23-27	decimal(xxx.x)	f5.1
4	PRECIPITATION	5-END	space 28-32	decimal(xxx.x)	f5.1
5	PRECIPITATION	5-END	space 33-37	decimal(xxx.x)	f5.1
6	PRECIPITATION	5-END	space 38-42	decimal(xxx.x)	f5.1