CHAPTER 31

SWAT INPUT DATA: MEASURED

SWAT directly simulates the loading of water, sediment and other constituents off of land areas in the watershed. To simulate the loading of water and pollutants from sources not associated with a land area (e.g. sewage treatment plants, regional groundwater recharge, etc.), SWAT allows point source information to be read in at any point along the channel network. The point source loadings may be summarized on an hourly, daily, monthly, yearly, or average annual basis.

Files containing the point source loads are created by the user. The loads are read into the model and routed through the channel network using rechour, recday, recmon, recyear, or reccnst commands in the watershed configuration file. SWAT will read in water, sediment, nutrients, CBOD, dissolved oxygen, chlorophyll-a, pesticide, metal, and bacteria data from the point source files. Chapter 2 reviews the format of the command lines in the watershed configuration file while Chapter 31 reviews the format of the point source files.

31.1 HOURLY RECORDS (RECHOUR .DAT FILE)

The rechour command in the watershed configuration (.fig) file requires a file containing SWAT input data summarized on a hourly time step.

An unlimited[*] number of files with hourly flow data are allowed in the simulation. The file numbers assigned to the rechour files in the watershed configuration file (.fig) must be ≥ 1 and numbered sequentially.

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

Variable name	Definition
TITLE	The first six lines of the file are reserved for user comments. The comments may take up to 80 spaces per line.
DAY	Julian date for record.
	If the julian date and year are provided for the records, SWAT will search for the beginning day of simulation in the record. If the julian date and year are left blank, SWAT assumes that the first line of record corresponds to the first day of simulation. SWAT uses the date and year to locate the record corresponding to the first day of simulation.
	Required.
YEAR	Four-digit year for record.
	See description of DAY for more information.
	Required.
HOUR	Hour in day for record.
	Required.
FLOHR	Contribution to streamflow for the hour (m^3).
	Required.
SEDHR	Sediment loading to reach for the hour (metric tons).
	Required.
ORGNHR	Organic N loading to reach for the hour (kg N).
	Required if nutrient cycling is being modeled.

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[*] Please keep in mind that FORTRAN limits the total number of files that can be open at one time to something in the neighborhood of 250. The input files containing daily/hourly data (.pcp, .tmp, rechour and recday) remain open throughout the simulation.

Variable name	Definition
ORGPHR	Organic P loading to reach for the hour (kg P).
	Required if nutrient cycling is being modeled.
NO3HR	NO_3 loading to reach for the hour (kg N).
	Required if nutrient cycling is being modeled.
NH3HR	NH_3 loading to reach for the hour (kg N).
	Required if nutrient cycling is being modeled.
NO2HR	NO_2 loading to reach for the hour (kg N).
	Required if nutrient cycling is being modeled.
MINPHR	Mineral P loading to reach for the hour (kg P).
	Required if nutrient cycling is being modeled.
CBODHR	Loading of CBOD to reach for the hour (kg CBOD).
	Required if nutrient cycling is being modeled.
DISOXHR	Loading of dissolved oxygen to reach for the hour (kg O2).
	Required if nutrient cycling is being modeled.
CHLAHR	Loading of chlorophyll a to reach for the hour (kg chla).
	Required if nutrient cycling is being modeled.
SOLPSTHR	Loading of soluble pesticide to reach for the hour (mg ai)
	The type of pesticide is defined by IRTPEST (in .bsn).
	Required if pesticide cycling is being modeled.
SRBPSTHR	Loading of sorbed pesticide to reach for the hour (mg ai)
	The type of pesticide is defined by IRTPEST (in .bsn).
	Required if pesticide cycling is being modeled.
BACTPHR	Loading of persistent bacteria to reach for the hour (# cfu/100 mL).
	Required if bacteria transport is being modeled.
BACTLPHR	Loading of less persistent bacteria to reach for the hour (# cfu/100 mL).
	Required if bacteria transport is being modeled.
CMTL1HR	Loading of conservative metal #1 to reach for the hour (kg).
	Required if heavy metal transport is being modeled.

Variable name	Definition
CMTL2HR	Loading of conservative metal #2 to reach for the hour (kg).
	Required if heavy metal transport is being modeled.
CMTL3HR	Loading of conservative metal #3 to reach for the hour (kg).
	Required if heavy metal transport is being modeled.

Twenty-four lines of data are required for every day of the simulation period. The rechour data file is a free format file. The variables may be placed in any position the user wishes on the line. Values for variables classified as integers *should not* include a decimal while values for variables classified as reals *must* contain a decimal. A blank space denotes the end of an input value and the beginning of the next value if there is another on the line. The format of the rechour data file is:

Variable name	Line #	Format	F90 Format
TITLE	1 - 6	character	a80
DAY	7-END	integer	free
YEAR	7-END	integer	free
HOUR	7-END	integer	free
FLOHR	7-END	real or exponential	free
SEDHR	7-END	real or exponential	free
ORGNHR	7-END	real or exponential	free
ORGPHR	7-END	real or exponential	free
NO3HR	7-END	real or exponential	free
NH3HR	7-END	real or exponential	free
NO2HR	7-END	real or exponential	free
MINPHR	7-END	real or exponential	free
CBODHR	7-END	real or exponential	Free
DISOXHR	7-END	real or exponential	Free
CHLAHR	7-END	real or exponential	Free
SOLPSTHR	7-END	real or exponential	Free
SRBPSTHR	7-END	real or exponential	Free
BACTPHR	7-END	real or exponential	Free
BACTLPHR	7-END	real or exponential	Free
CMTL1HR	7-END	real or exponential	Free
CMTL2HR	7-END	real or exponential	Free
CMTL3HR	7-END	real or exponential	Free

31.2 DAILY RECORDS (RECDAY .DAT FILE)

The recday command in the watershed configuration (.fig) file requires a file containing SWAT input data summarized on a daily time step. An unlimited[*] number of files with daily flow data are allowed in the simulation. The file numbers assigned to the recday files in the watershed configuration file (.fig) must be ≥ 1 and numbered sequentially.

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

Variable name	Definition
TITLE	The first six lines of the file are reserved for user comments. The comments may take up to 80 spaces per line.
DAY	Julian date for record
	If the julian date and year are provided for the records, SWAT will search for the beginning day of simulation in the record. If the julian date and year are left blank, SWAT assumes that the first line of record corresponds to the first day of simulation. SWAT uses the date and year to locate the record corresponding to the first day of simulation.
	Required.
YEAR	Four-digit year for record.
	See description of DAY for more information.
	Required.
FLODAY	Contribution to streamflow for the day (m^3).
	Required.
SEDDAY	Sediment loading to reach for the day (metric tons).
	Required.
ORGNDAY	Organic N loading to reach for the day (kg N).
	Required if nutrient cycling being modeled.
ORGPDAY	Organic P loading to reach for the day (kg P).
	Required if nutrient cycling being modeled.

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[*] Please keep in mind that FORTRAN limits the total number of files that can be open at one time to something in the neighborhood of 250. The input files containing daily data (.pcp, .tmp, and recday) remain open throughout the simulation.

Variable name	Definition
NO3DAY	NO_3 loading to reach for the day (kg N).
	Required if nutrient cycling being modeled.
NH3DAY	NH_3 loading to reach for the day (kg N).
	Required if nutrient cycling being modeled.
NO2DAY	NO_2 loading to reach for the day (kg N).
	Required if nutrient cycling being modeled.
MINPDAY	Mineral P loading to reach for the day (kg P).
	Required if nutrient cycling being modeled.
CBODDAY	Loading of CBOD to reach for the day (kg CBOD).
	Required if nutrient cycling being modeled.
DISOXDAY	Loading of dissolved oxygen to reach for the day (kg O2).
	Required if nutrient cycling being modeled.
CHLADAY	Loading of chlorophyll a to reach for the day (kg chla).
	Required if nutrient cycling being modeled.
SOLPSTDAY	Loading of soluble pesticide for the day (mg ai)
	The type of pesticide is defined by IRTPEST (in .bsn).
	Required if pesticide cycling being modeled.
SRBPSTDAY	Loading of sorbed pesticide for the day (mg ai)
	The type of pesticide is defined by IRTPEST (in .bsn).
	Required if pesticide cycling being modeled.
BACTPDAY	Loading of persistent bacteria to reach for the day (# cfu/100 mL).
	Required if bacteria transport being modeled.
BACTLPDAY	Loading of less persistent bacteria to reach for the day (# cfu/100 mL).
	Required if bacteria transport being modeled.
CMTL1DAY	Loading of conservative metal #1 to reach for the day (kg).
	Required if heavy metal transport being modeled.
CMTL2DAY	Loading of conservative metal #2 to reach for the day (kg).
	Required if heavy metal transport being modeled.

Variable name	Definition
CMTL3DAY	Loading of conservative metal #3 to reach for the day (kg).
	Required if heavy metal transport being modeled.

One line of data is required for every day of the simulation period. The recday data file is a free format file. The variables may be placed in any position the user wishes on the line. Values for variables classified as integers *should not* include a decimal while values for variables classified as reals *must* contain a decimal. A blank space denotes the end of an input value and the beginning of the next value if there is another on the line. The format of the recday data file is:

Variable name	Line #	Format	F90 Format
TITLE	1 - 6	character	a80
DAY	7-END	integer	free
YEAR	7-END	integer	free
FLODAY	7-END	real or exponential	free
SEDDAY	7-END	real or exponential	free
ORGNDAY	7-END	real or exponential	free
ORGPDAY	7-END	real or exponential	free
NO3DAY	7-END	real or exponential	free
NH3DAY	7-END	real or exponential	free
NO2DAY	7-END	real or exponential	free
MINPDAY	7-END	real or exponential	free
CBODDAY	7-END	real or exponential	free
DISOXDAY	7-END	real or exponential	free
CHLADAY	7-END	real or exponential	free
SOLPSTDAY	7-END	real or exponential	free
SRBPSTDAY	7-END	real or exponential	free
BACTPDAY	7-END	real or exponential	free
BACTLPDAY	7-END	real or exponential	free
CMTL1DAY	7-END	real or exponential	free
CMTL2DAY	7-END	real or exponential	free
CMTL3DAY	7-END	real or exponential	free

31.3 MONTHLY RECORDS (RECMON .DAT FILE)

The recmon command in the watershed configuration (.fig) file requires a file containing input data summarized on a monthly time step. SWAT will accept an unlimited number of data files with monthly flow data. The file numbers assigned to the files in the watershed configuration file (.fig) must be numbered sequentially and begin at 1.

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

Variable name	Definition
TITLE	The first 6 lines of the data file is reserved for user comments. The comments may take up to 80 spaces.
MONTH	Month of measured data.
	This variable is provided for the user—it is ignored by SWAT. The model assumes the first line of measured data in the file contains data for January of the first year of simulation. The monthly data file must contain a line of data for every month of simulation in consecutive order.
	Required.
YEAR	4-digit year of measured data.
	This variable is provided for the user—it is ignored by SWAT. The model assumes the first line of measured data in the file contains data for January of the first year of simulation. The monthly data file must contain a line of data for every month of simulation in consecutive order.
	Required.
FLOMON	Average daily water loading for month (m^3/day).
	Required.
SEDMON	Average daily sediment loading for month (metric tons/day).
	Required.
ORGNMON	Average daily organic nitrogen loading for month (kg N/day).
	Required if nutrient cycling being modeled.

Variable name	Definition
ORGPMON	Average daily organic phosphorus loading for month (kg P/day).
	Required if nutrient cycling being modeled.
NO3MON	Average daily nitrate loading for month (kg N/day).
	Required if nutrient cycling being modeled.
NH3MON	Average daily ammonia loading for month (kg N/day).
	Required if nutrient cycling being modeled.
NO2MON	Average daily nitrite loading for month (kg N/day).
	Required if nutrient cycling being modeled.
MINPMON	Average daily mineral (soluble) P loading for month (kg P/day).
	Required if nutrient cycling being modeled.
CBODMON	Average daily loading of CBOD for month (kg CBOD/day).
	Required if nutrient cycling being modeled.
DISOXMON	Average daily loading of dissolved oxygen for month (kg O_2/day).
	Required if nutrient cycling being modeled.
CHLAMON	Average daily loading of chlorophyll *a* for month (kg chla/day).
	Required if nutrient cycling being modeled.
SOLPSTMON	Average daily loading of soluble pesticide for month (mg ai/day)
	The type of pesticide is defined by IRTPEST (in .bsn).
	Required if pesticide cycling being modeled.
SRBPSTMON	Average daily loading of sorbed pesticide for month (mg ai/day).
	The type of pesticide is defined by IRTPEST (in .bsn).
	Required if pesticide cycling being modeled.
BACTPMON	Average daily loading of persistent bacteria for month (# cfu/100 mL).
	Required if bacteria transport being modeled.

Variable name	Definition
BACTLPMON	Average daily loading of less persistent bacteria for month (# cfu/100 mL).
	Required if bacteria transport being modeled.
CMTL1MON	Average daily loading of conservative metal #1 for month (kg/day).
	Required if heavy metal transport being modeled.
CMTL2MON	Average daily loading of conservative metal #2 for month (kg/day).
	Required if heavy metal transport being modeled.
CMTL3MON	Average daily loading of conservative metal #3 for month (kg /day).
	Required if heavy metal transport being modeled.

The file must contain one line of data for every month of simulation (Even if the simulation begins in a month other than January, the file must contain lines for every month of the first year.) The recmon data file is a free format file. The variables may be placed in any position the user wishes on the line. Values for variables classified as integers *should not* include a decimal while values for variables classified as reals *must* contain a decimal. A blank space denotes the end of an input value and the beginning of the next value if there is another on the line. The format of the recmon data file is:

Variable name	Line #	Format	F90 Format
TITLE	1-6	character	a80
MONTH	7 – END	integer	free
YEAR	7 – END	integer	free
FLOMON	7 – END	real or exponential	free
SEDMON	7 – END	real or exponential	free
ORGNMON	7 – END	real or exponential	free
ORGPMON	7 – END	real or exponential	free
NO3MON	7 – END	real or exponential	free
NH3MON	7 – END	real or exponential	free
NO2MON	7 – END	real or exponential	free
MINPMON	7 – END	real or exponential	free
CBODMON	7 – END	real or exponential	free

Variable name	Line #	Format	F90 Format
DISOXMON	7 – END	real or exponential	free
CHLAMON	7 – END	real or exponential	free
SOLPSTMON	7 – END	real or exponential	free
SRBPSTMON	7 – END	real or exponential	free
BACTPMON	7 – END	real or exponential	free
BACTLPMON	7 – END	real or exponential	free
CMTL1MON	7 – END	real or exponential	free
CMTL2MON	7 – END	real or exponential	free
CMTL3MON	7 – END	real or exponential	free

31.4 YEARLY RECORDS (RECYEAR .DAT FILE)

The recyear command in the watershed configuration (.fig) file requires a file containing SWAT input data summarized on an annual time step. SWAT will accept an unlimited number of data files with yearly flow data. The file numbers assigned to the recyear files in the watershed configuration file (.fig) must be numbered sequentially and begin at 1.

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

Variable name	Definition
TITLE	The first six lines of the data file are reserved for user comments. The comments may take up to 80 spaces per line.
YEAR	4-digit year of measured data.
	This variable is provided for the user—it is ignored by SWAT. The model assumes the first line of measured data in the file contains data for the first year of simulation. The yearly data file must contain a line of data for every year of simulation in consecutive order.
	Required.
FLOYR	Average daily water loading for year (m^3/day).
	Required.
SEDYR	Average daily sediment loading for year (metric tons/day).
	Required.
ORGNYR	Average daily organic nitrogen loading for year (kg N/day).
	Required if nutrient cycling being modeled.
ORGPYR	Average daily organic phosphorus loading for year (kg P/day).
	Required if nutrient cycling being modeled.
NO3YR	Average daily nitrate loading for year (kg N/day).
	Required if nutrient cycling being modeled.

Variable name	Definition
NH3YR	Average daily ammonia loading for year (kg N/day).
	Required if nutrient cycling being modeled.
NO2YR	Average daily nitrite loading for year (kg N/day).
	Required if nutrient cycling being modeled.
MINPYR	Average daily mineral (soluble) P loading for year (kg P/day).
	Required if nutrient cycling being modeled.
CBODYR	Average daily loading of CBOD for year (kg CBOD/day).
	Required if nutrient cycling being modeled.
DISOXYR	Average daily loading of dissolved oxygen for year (kg O2/day).
	Required if nutrient cycling being modeled.
CHLAYR	Average daily loading of chlorophyll *a* for year (kg/day).
	Required if nutrient cycling being modeled.
SOLPSTYR	Average daily loading of soluble pesticide for year (mg ai/day).
	The type of pesticide is defined by IRTPEST (in .bsn).
	Required if pesticide cycling being modeled.
SRBPSTYR	Average daily loading of sorbed pesticide for year (mg ai/day).
	The type of pesticide is defined by IRTPEST (in .bsn).
	Required if pesticide cycling being modeled.
BACTPYR	Average daily loading of persistent bacteria for year (# cfu/100 mL).
	Required if bacteria transport being modeled.
BACTLPYR	Average daily loading of less persistent bacteria for year (# cfu/100 mL).
	Required if bacteria transport being modeled.
CMTL1YR	Average daily loading of conservative metal #1 for year (kg/day).
	Required if heavy metal transport being modeled.

Variable name	Definition
CMTL2YR	Average daily loading of conservative metal #2 for year (kg/day).
	Required if heavy metal transport being modeled.
CMTL3YR	Average daily loading of conservative metal #3 for year (kg/day).
	Required if heavy metal transport being modeled.

The recyear data file is a free format file. The variables may be placed in any position the user wishes on the line. Values for variables classified as integers *should not* include a decimal while values for variables classified as reals *must* contain a decimal. A blank space denotes the end of an input value and the beginning of the next value if there is another on the line.The format of the recyear data file is:

Variable name	Line #	Format	F90 Format
TITLE	1 - 6	character	a80
YEAR	7 - END	integer	free
FLOYR	7 - END	real or exponential	free
SEDYR	7 - END	real or exponential	free
ORGNYR	7 - END	real or exponential	free
ORGPYR	7 - END	real or exponential	free
NO3YR	7 - END	real or exponential	free
NH3YR	7 - END	real or exponential	free
NO2YR	7 - END	real or exponential	free
MINPYR	7 - END	real or exponential	free
CHLAYR	7 - END	real or exponential	free
DISOXYR	7 - END	real or exponential	free
CBODYR	7 - END	real or exponential	free
SOLPSTYR	7 - END	real or exponential	free
SRBPSTYR	7 - END	real or exponential	free
BACTPYR	7 - END	real or exponential	free
BACTLPYR	7 - END	real or exponential	free

Variable name	Line #	Format	F90 Format
CMTL1YR	7 - END	real or exponential	free
CMTL2YR	7 - END	real or exponential	free
CMTL3YR	7 - END	real or exponential	free

31.5 AVERAGE ANNUAL RECORDS
(RECCNST .DAT FILE)

The reccnst command in the watershed configuration (.fig) file requires a file containing average annual SWAT input data. SWAT will accept an unlimited number of data files with average annual flow data. The file numbers assigned to the reccnst files in the watershed configuration file (.fig) must be numbered sequentially and begin at 1.

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

Variable name	Definition
TITLE	The first six lines of the data file are reserved for user comments. The comments may take up to 80 spaces on each line.
FLOCNST	Average daily water loading (m^3/day).
	Required.
SEDCNST	Average daily sediment loading (metric tons/day).
	Required.
ORGNCNST	Average daily organic N loading (kg N/day).
	Required if nutrient cycling being modeled.
ORGPCNST	Average daily organic P loading (kg P/day).
	Required if nutrient cycling being modeled.
NO3CNST	Average daily NO_3 loading (kg N/day).
	Required if nutrient cycling being modeled.
NH3CNST	Average daily NH_3 loading (kg N/day).
	Required if nutrient cycling being modeled.
NO2CNST	Average daily NO_2 loading (kg N/day).
	Required if nutrient cycling being modeled.
MINPCNST	Average daily mineral P loading (kg P/day).
	Required if nutrient cycling being modeled.

Variable name	Definition
CBODCNST	Average daily loading of CBOD (kg CBOD/day).
	Required if nutrient cycling being modeled.
DISOXCNST	Average daily loading of dissolved oxygen (kg O_2/day).
	Required if nutrient cycling being modeled.
CHLACNST	Average daily loading of chlorophyll *a* (kg/day).
	Required if nutrient cycling being modeled.
SOLPSTCNST	Average daily loading of soluble pesticide (mg ai/day).
	The type of pesticide is defined by IRTPEST (in .bsn).
	Required if pesticide cycling being modeled.
SRBPSTCNST	Average daily loading of sorbed pesticide (mg ai/day).
	The type of pesticide is defined by IRTPEST (in .bsn).
	Required if pesticide cycling being modeled.
BACTPCNST	Average daily loading of persistent bacteria (# cfu/100 mL).
	Required if bacteria transport being modeled.
BACTLPCNST	Average daily loading of less persistent bacteria (# cfu/100 mL).
	Required if bacteria transport being modeled.
CMTL1CNST	Average daily loading of conservative metal #1 (kg/day).
	Required if heavy metal transport being modeled.
CMTL2CNST	Average daily loading of conservative metal #2 (kg/day).
	Required if heavy metal transport being modeled.
CMTL3CNST	Average daily loading of conservative metal #3 (kg/day).
	Required if heavy metal transport being modeled.

The format of the reccnst data file is:

Variable name	Line #	Format	F90 Format
TITLE	1-6	character	a80
FLOCNST	7	real or exponential	Free
SEDCNST	7	real or exponential	Free
ORGNCNST	7	real or exponential	Free
ORGPCNST	7	real or exponential	Free
NO3CNST	7	real or exponential	Free
NH3CNST	7	real or exponential	Free
NO2CNST	7	real or exponential	Free
MINPCNST	7	real or exponential	Free
CBODCNST	7	real or exponential	Free
DISOXCNST	7	real or exponential	Free
CHLACNST	7	real or exponential	Free
SOLPSTCNST	7	real or exponential	Free
SRBPSTCNST	7	real or exponential	Free
BACTPCNST	7	real or exponential	Free
BACTLPCNST	7	real or exponential	Free
CMTL1CNST	7	real or exponential	Free
CMTL2CNST	7	real or exponential	Free
CMTL3CNST	7	real or exponential	Free