



PRMS-IV, the Precipitation-Runoff Modeling System, Version 4

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Table 2. Description of modules implemented in the Precipitation-Runoff Modeling System, version 4 (PRMS-IV).

Module name	Description
Basin definition process	
basin	Defines shared watershed-wide and hydrologic response unit (HRU) physical parameters and variables.
Cascading flow process	
cascade	Determines computational order of the HRUs and groundwater reservoirs for routing flow downslope.
Solar table process	
soltab	Compute potential solar radiation and sunlight hours for each HRU for each day of year.
Time series data process	
obs	Reads and stores observed data from all specified measurement stations.
Temperature distribution process	
temp_1sta	Distributes maximum and minimum temperatures to each HRU by using temperature data measured at one station and an estimated monthly lapse rate.
temp_laps	Distributes maximum and minimum temperatures to each HRU by computing a daily lapse rate with temperature data measured at two stations.
temp_dist2	Distributes maximum and minimum temperatures to each HRU by using a basin-wide lapse rate applied to the temperature data, adjusted for distance, measured at each station.
climate_hru	Reads distributed temperature values directly from files.
Precipitation distribution process	
precip_1sta	Determines the form of precipitation and distributes it from one or more stations to each HRU by using monthly correction factors to account for differences in altitude, spatial variation, topography, and measurement gage efficiency.
precip_laps	Determines the form of precipitation and distributes it to each HRU by using monthly lapse rates.
precip_dist2	Determines the form of precipitation and distributes it to each HRU by using an inverse distance weighting scheme.
climate_hru	Reads distributed precipitation values directly from files.
Combined climate distribution process	
ide_dist	Determines the form of precipitation and distributes precipitation and temperatures to each HRU on the basis of measurements at stations with closest elevation or shortest distance to the respective HRU.
xyz_dist	Determines the form of precipitation and distributes precipitation and temperatures to each HRU by using a multiple linear regression of measured data from a group of measurement stations or from atmospheric model simulation.
climate_hru	Reads distributed climate values directly from files.
Solar radiation distribution process	
ddsolrad	Distributes solar radiation to each HRU and estimates missing solar radiation data using a maximum temperature per degree-day relation.
ccsolrad	Distributes solar radiation to each HRU and estimates missing solar radiation data using a relation between solar radiation and cloud cover.
climate_hru	Reads distributed solar radiation values directly from files.
Transpiration period process	
transp_frost	Determines whether the current time step is in a period of active transpiration by the killing frost

transp_tindex	method. Determines whether the current time step is in a period of active transpiration by the temperature index method.
climate_hru	Reads the state of transpiration directly from files.
Potential evapotranspiration process	
potet_hamon	Computes the potential evapotranspiration by using the Hamon formulation (Hamon, 1961).
potet_jh	Computes the potential evapotranspiration by using the Jensen-Haise formulation (Jensen and Haise, 1963).
potet_hs	Computes the potential evapotranspiration by using the Hargreaves-Samani formulation (Hargreaves and Samani, 1982).
potet_pt	Computes the potential evapotranspiration by using the Priestley-Taylor formulation (Priestley and Taylor, 1972).
potet_pm	Computes the potential evapotranspiration by using the Penman-Monteith formulation (Penman, 1948; Monteith, 1965) using specified windspeed and humidity in CBH Files.
potet_pm_sta	Computes the potential evapotranspiration by using the Penman-Monteith formulation (Penman, 1948; Monteith, 1965) using specified windspeed and humidity in the PRMS Data File.
potet_pan	Computes the potential evapotranspiration for each HRU by using pan-evaporation data.
climate_hru	Reads distributed potential evapotranspiration values directly from files.
Canopy Interception process	
intcp	Computes volume of intercepted precipitation, evaporation from intercepted precipitation, and throughfall that reaches the soil or snowpack.
Snow process	
snowcomp	Initiates development of a snowpack and simulates snow accumulation and depletion processes by using an energy-budget approach.
Surface runoff process	
srunoff_smidx	Computes surface runoff and infiltration for each HRU by using a nonlinear variable-source-area method allowing for cascading flow.
srunoff_carea	Computes surface runoff and infiltration for each HRU by using a linear variable-source-area method allowing for cascading flow.
Soil-zone process	
soilzone	Computes inflows to and outflows from soil zone of each HRU and includes inflows from infiltration, groundwater, and upslope HRUs, and outflows to gravity drainage, interflow, and surface runoff to down-slope HRUs.
Groundwater process	
gwflow	Sums inflow to and outflow from PRMS groundwater reservoirs; outflow can be routed to downslope groundwater reservoirs and stream segments.
Streamflow process	
strmflow	Computes daily streamflow as the sum of surface runoff, shallow-subsurface flow, detention reservoir flow, and groundwater flow.
muskingum	Routes water between segments in the system using Muskingum routing.
routing	Computes streamflow routing order and common streamflow routing results, used when modules muskingum or strmflow_in_out are active.
strmflow in out	Routes water between segments in the system by setting the outflow to the inflow.
Summary process	
basin_sum	Computes daily, monthly, yearly, and total flow summaries of volumes and flows for all HRUs.
subbasin	Computes streamflow at internal basin nodes and variables by subbasin.
map_results	Writes HRU summaries to a user specified target map at weekly, monthly, yearly, and total time steps.
basin_summary	Write selected user-selected basin area-weighted results (values with one as the dimension) to separate CSV Files at daily, monthly, mean monthly, mean yearly, and yearly total time steps

nhru_summary	when control parameter basinOutON_OFF is specified equal to 1. Write selected user-selected results dimensioned by the value of dimension nhru to separate CSV Files at daily, monthly, mean monthly, mean yearly, and yearly total time steps when control parameter nhruOutON_OFF is specified equal to 1.
nsegment_summary	Write selected user-selected results dimensioned by the value of dimension nsegment to separate CSV Files at daily, monthly, mean monthly, mean yearly, and yearly total time steps when control parameter nsegmentOutON_OFF is specified equal to 1.
nsub_summary	Write selected user-selected results dimensioned by the value of dimension nsub to separate CSV Files at daily, monthly, mean monthly, mean yearly, and yearly total time steps when control parameter nsubOutON_OFF is specified equal to 1.

Table 1-1. Dimensions used in the Precipitation-Runoff Modeling System, version 4 (PRMS-IV).

[HRU, hydrologic response unit; GWR, groundwater reservoir; >, greater than; control parameters **temp_module**, **precip_module**, **solrad_module**, **et_module**, **strmflow_module**, **subbasin_flag**, **cascade_flag**, **cascadegw_flag**, **model_mode** and **mapOutON_OFF** defined in table 1-2; parameter **hru_solsta** defined in table 1-3]

Dimension ³	Description	Default	Required/Condition
Spatial dimensions			
ngw ²	Number of GWRs	1	required
ngwcell	Number of spatial units in the target map for mapped results	0	mapOutON_OFF = 1 or model_mode = GSFLOW
nhru	Number of hydrologic response units	1	required
nhrucell	Number of unique intersections between HRUs and spatial units of a target map for mapped results	0	mapOutON_OFF = 1 or model_mode = GSFLOW
nlake	Number of lakes	0	required when any HRU has hru_type specified equal to 2
nreach	Number of reaches on all stream segments	0	model_mode = GSFLOW
nsegment	Number of stream-channel segments	0	strmflow_module = muskingum or strmflow_in_out or cascade_flag = 1 or cascadegw_flag = 1 or model_mode = GSFLOW
nssr ²	Number of subsurface reservoirs	1	required
nsub	Number of internal subbasins	0	subbasin_flag = 1
Time-series input data dimensions ¹			
nevap	Number of pan-evaporation data sets	0	et_module = potet_pan
nhumid	Number of relative humidity measurement stations	0	optional
nobs	Number of streamflow-measurement stations	0	replacement flow when strmflow_module = muskingum, or strmflow_in_out
nrain	Number of precipitation-measurement stations	0	precip_module = precip_1sta, precip_laps, precip_dist2, ide_dist, or xyz_dist
nsnow	Number of snow-depth measurement stations	0	optional
nsol	Number of solar-radiation measurement stations	0	computation of solar radiation distribution using parameter hru_solsta
ntemp	Number of air-temperature-measurement stations	0	temp_module = temp_1sta, temp_laps, temp_dist2, ide_dist, or xyz_dist
nwind	Number of wind-speed measurement stations	0	optional
Computation dimensions			
ncascade	Number of HRU links for cascading flow	0	cascade_flag = 1
ncascdgw	Number of GWR links for cascading flow	0	cascadegw_flag = 1 or 2
ndepl	Number of snow-depletion curves	1	required
ndeplval	Number of values in all snow-depletion curves (set to ndepl *11)	11	required

Dimension ³	Description	Default	Required/Condition
Fixed dimensions			
ndays	Maximum number of days in a year	366	optional
nlapse	Number of lapse rates in X, Y, and Z directions	3	precip_module = xyz_dist
nmonths	Number of months in a year	12	optional
one	Dimension of scalar parameters and variables	1	optional

¹All associated data specified in Data File can be used for calibration purposes.

²Use of **nssr** and **ngw** not equal to **nhru** is deprecated.

³Dimensions that do not have an associated parameter specified in the Parameter File or variable specified in the Data File are optional.

Table 1-2. Parameters specified in the Control File for the Precipitation-Runoff Modeling System, version 4 (PRMS-IV).

[Data Type: 1=integer, 2=single precision floating point (real), 3=double precision floating point (double); 4=character string; HRU, hydrologic response unit; GWR, groundwater reservoir; CBH, climate-by-HRU; ET, evapotranspiration; >, greater than; dimensions **ncascade**, **ncascdgw**, and **nsub** defined in table 1-1; the first two blocks of control parameters listed in the table are recommended for every simulation, though all parameters are optional depending appropriateness of the default values]

Parameter name ⁴	Description	Option	Number of Values	Data type	Default value
Simulation execution and required input and output files					
csv_output_file	Pathname for GSFLOW Comma-Separated-Values (CSV) File of GSFLOW water budget and mass balance results for each time step	model_mode = GSFLOW	1	4	<i>gsflow.csv</i>
data_file ²	Pathname(s) for measured input Data File(s), typically a single Data File is specified	measured input	number of Data Files	4	<i>prms.data</i>
end_time	Simulation end date and time specified in order in the control item as: year, month, day, hour, minute, second	time period	6	1	2001, 9, 30, 0, 0, 0
gsf_rpt	Switch to specify whether or not the GSFLOW Comma-Separated-Values (CSV) File is generated (0=no; 1=yes)	model_mode = GSFLOW	1	1	1
gsflow_output_file	Pathname for MODFLOW Name File	model_mode = GSFLOW or MODFLOW	1	4	<i>modflow.nam</i>
model_mode	Flag to indicate the simulation mode (PRMS=PRMS; FROST=growing season for each HRU; WRITE_CLIMATE=write CBH files of minimum and maximum air temperature (variables <i>tminf</i> and <i>tmaxf</i> -Fahrenheit); precipitation (variable <i>hru_ppt</i> -inches); solar radiation (variable <i>swrad</i> -Langley); potential ET (variable <i>potet</i> -inches); and/or transpiration flag (variable <i>transp_on</i> -none); DOCUMENTATION=write files of all declared parameters and variables in the executable)	simulation mode selection	1	4	PRMS
model_output_file ²	Pathname for Water-Budget File for results module <i>basin_sum</i>	simulation output	1	4	<i>prms.out</i>
modflow_name	Pathname for GSFLOW Comma-Separated-Values (CSV) File of GSFLOW water budget and mass balance results for each time step	model_mode = GSFLOW	1	4	<i>gsflow.csv</i>
param_file ²	Pathname(s) for Parameter File(s)	parameter input	number of Parameter Files	4	<i>prms.params</i>
prms_warmup	Number of years to simulate before writing Basin, nsub , or nsegment Summary Output Files	basinOutON_OFF = 1, or nsegmentOutON_OFF or nsubOutON_OFF = 1	1	1	1
rpt_days	Frequency that summary tables are written to the GSFLOW Water-Budget File (0=none; >0=frequency in days, e.g., 1 = daily,	model_mode = GSFLOW	1	1	7

Parameter name ⁴	Description	Option	Number of Values	Data type	Default value
start_time	7=every 7th day) Simulation start date and time specified in order in the control item as: year, month, day, hour, minute, second	time period	6	1	2000, 10, 1, 0, 0, 0
Module selection and simulation options					
cascade_flag	Flag to indicate if HRU cascades are computed (0=no; 1=yes)	cascade flow with ncascade > 0	1	1	1
cascadegw_flag	Flag to indicate if GWR cascades are computed (0=no; 1=yes; 2 = GWR cascades are set equal to the HRU cascades and parameters gw_up_id , gw_strmseg_down_in , gw_down_id , and gw_pct_up are not required)	cascade flow with ncascdgw > 0	1	1	1
dprst_flag	Flag to indicate if depression-storage simulation is computed (0=no; 1=yes)	surface-depression storage	1	1	0
et_module	Module name for potential evapotranspiration method (climate_hru, potet_jh, potet_hamon, potet_hs, potet_pt, potet_pm, potet_pm_sta, or potet_pan)	module selection	1	4	potet_jh
gwr_swale_flag	Flag to indicate if GWR swales are allowed (0=no; 1=groundwater flow goes to groundwater sink; 3=groundwater flow goes to stream segment specified using parameter hru_segment)	swales	1	1	0
precip_module	Module name for precipitation-distribution method (climate_hru, ide_dist, precip_1sta, precip_dist2, precip_laps, or xyz_dist)	module selection	1	4	precip_1sta
solrad_module	Module name for solar-radiation-distribution method (ccsolrad or ddsolrad)	module selection	1	4	ddsolrad
srunoff_module	Module name for surface-runoff/infiltration computation method (srunoff_carea or srunoff_smidx)	module selection	1	4	srunoff_smidx
strmflow_module	Module name for streamflow routing simulation method (strmflow, muskingum, or strmflow_in_out)	module selection	1	4	strmflow
subbasin_flag	Flag to indicate if internal subbasin are computed (0=no; 1=yes)	nsub > 0	1	1	1
temp_module	Module name for temperature-distribution method (climate_hru, temp_1sta, temp_dist2, temp_laps, ide_dist, or xyz_dist)	module selection	1	4	temp_1sta
transp_module	Module name for transpiration simulation method (climate_hru, transp_frost, or transp_tindex)	module selection	1	4	transp_tindex
Climate-by-HRU Files					
cbh_binary_flag	Flag to specify whether to input CBH files in a binary format using the same order of values as the text file version (0=no;	input options	1	1	0

Parameter name ⁴	Description	Option	Number of Values	Data type	Default value
humidity_day^{2,3}	1=yes) Pathname of the CBH file of pre-processed humidity input data for each HRU to specify variable <i>humidity_hru</i> -percentage	et_module = potet_pm, potet_pm_sta, or potet_pt	1	4	humidity.day
orad_flag	Flag to specify whether or not the variable <i>orad</i> is specified as the last column of the swrad_day CBH file (0=no; 1=yes)	solrad_module = climate_hru	1	1	1
potet_day²	Pathname of the CBH file of pre-processed potential-ET input data for each HRU to specify variable <i>potet</i> -inches	et_module = climate_hru	1	4	potet.day
precip_day²	Pathname of the CBH file of pre-processed precipitation input data for each HRU to specify variable <i>precip</i> -inches	precip_module = climate_hru	1	4	precip.day
swrad_day²	Pathname of the CBH file of pre-processed solar-radiation input data for each HRU to specify variable <i>swrad</i> -Langley's	solrad_module = climate_hru	1	4	swrad.day
tmax_day²	Pathname of the CBH file of pre-processed maximum air temperature input data for each HRU to specify variable <i>tmaxf</i> -degrees Fahrenheit	temp_module = climate_hru	1	4	tmax.day
tmin_day²	Pathname of the CBH file of pre-processed minimum air temperature input data for each HRU to specify variable <i>tminf</i> -degrees Fahrenheit	temp_module = climate_hru	1	4	tmin.day
transp_day²	Pathname of the CBH file of pre-processed transpiration on or off flag for each HRU file to specify variable <i>transp_on</i> -none	transp_module = climate_hru	1	4	transp.day
windspeed_day²	Pathname of the CBH file of pre-processed wind speed input data for each HRU to specify variable <i>windspeed_hru</i> -meters/second	et_module = potet_pm	1	4	windspeed.day
Debug options					
cbh_check_flag	Flag to indicate if CBH values are validated each time step (0=no; 1=yes)	CBH input	1	1	1
parameter_check_flag	Flag to indicate if selected parameter values validation checks are treated as warnings or errors (0=no; 1=yes; 2=check parameters and then stop)	parameter validation check	1	1	1
print_debug¹	Flag to indicate type of debug output (-1=minimize screen output; 0=none; 1=water balances; 2=basin module; 4=basin_sum module; 5=soltab module; 7=soilzone module; 9=snowcomp module; 13=cascade module; 14=subbasin module)	debug output	1	1	0
Statistic Variables (statvar) Files					
nstatVars	Number of variables to include in Statistics Variables File and names specified in statVar_names	statsON_OFF = 1	1	1	0
stat_var_file²	Pathname for Statistics Variables File	statsON_OFF = 1	1	4	statvar.out

Parameter name ⁴	Description	Option	Number of Values	Data type	Default value
statsON_OFF	Switch to specify whether or not the Statistics Variables File is generated (0=no; 1=statvar text format; 2=CSV format)	statsON_OFF = 1	1	1	0
statVar_element	List of identification numbers corresponding to variables specified in statVar_names list (1 to variable's dimension size)	statsON_OFF = 1	nstatVars	4	none
statVar_names	List of variable names for which output is written to Statistics Variables File	statsON_OFF = 1	nstatVars	4	none
Initial Condition Files					
init_vars_from_file	Flag to specify whether or not the Initial Conditions File is specified as an input file (0=no; 1=yes; 2=yes and use parameter values in Parameter File instead of values in Initial Conditions File)	initial condtns	1	1	0
save_vars_to_file	Flag to determine if an Initial Conditions File will be generated at the end of simulation (0=no; 1=yes)	initial condtns	1	1	0
var_init_file ²	Pathname for Initial Conditions input file	init_vars_from_file = 1	1	4	prms_ic.in
var_save_file ²	Pathname for the Initial Conditions File to be generated at end of simulation	save_vars_to_file = 1	1	4	prms_ic.out
Animation Files					
ani_output_file ²	Root pathname for Animation Files(s) to which a filename suffix based on dimension name associated with selected variables is appended	aniOutON_OFF = 1	1	4	animation.out
aniOutON_OFF	Switch to specify whether or not Animation File(s) are generated (0=no; 1=yes)	animation output	1	1	0
aniOutVar_names	List of variable names for which all values of the variable (that is, the entire dimension size) for each time step are written Animation Dimension Files(s)	aniOutON_OFF = 1	naniOutVars	4	none
naniOutVars	Number of output variables specified in the aniOutVar_names list	aniOutON_OFF = 1	1	1	0
Mapped Results Files					
mapOutON_OFF	Switch to specify whether or not mapped output file(s) by a specified number of columns (parameter ncol) of daily, weekly, monthly, yearly, or total simulation results is generated (0=no; 1=yes)	mapped results	1	1	0
mapOutVar_names	List of variable names for which output is written to mapped output files(s)	map_resultsON_OFF = 1	nmapOutVars	4	none
nmapOutVars	Number of variables to include in mapped output file(s)	map_resultsON_OFF = 1	1	1	0

nhru Summary Results Files

Parameter name ⁴	Description	Option	Number of Values	Data type	Default value
nhruOutBaseFileName ²	String to define the prefix for each nhru Summary Output File.	nhruOutON_OFF = 1	1	4	none
nhruOutON_OFF	Switch to specify whether or not nhru Summary Output Files are generated (0=no; 1=yes)	nhru summary results	1	1	0
nhruOutVar_names	List of variable names for which output is written to nhru Summary Comma Separated Values (CSV) Output File(s). Each variable is written to a separate file with the prefix of each file equal to the value of nhruOutBaseFileName ; variables must be of type real or double. Each variable is written to a separate file with the prefix of each file equal to the value of nhruOutBaseFileName . The suffix of the files is based on the value of nhruOut_freq and will be .csv; _meanyear.csv; _yearly.csv; _meanmonthly.csv; or _monthly.csv. Variables must be of type real or double	nhruOutON_OFF = 1	nhruOutVars	4	none
nhruOutVars	Number of variables to include in nhru Summary Output File(s)	nhruOutON_OFF = 1	1	1	0
nhruOut_freq	Output frequency and type (1=daily; 2=monthly; 3=both; 4=mean monthly; 5=mean yearly; 6=yearly)	nhruOutON_OFF = 1	1	1	1
nsegment Summary Files					
nsegmentOutBaseFileName ²	String to define the prefix for each nsegment Summary Output File.	nsegmentOutON_OFF = 1	1	4	none
nsegmentOutON_OFF	Switch to specify whether or not nsegment Summary Output Files are generated (0=no; 1=yes)	nsegment summary results	1	1	0
nsegmentOutVar_names	List of variable names for which output is written to nsegment Summary Comma Separated Values (CSV) Output File(s). Each variable is written to a separate file with the prefix of each file equal to the value of nsegmentOutBaseFileName ; variables must be of type real or double. Each variable is written to a separate file with the prefix of each file equal to the value of nsegmentOutBaseFileName . The suffix of the files is based on the value of nsegmentOut_freq and will be .csv; _meanyear.csv; _yearly.csv; _meanmonthly.csv; or _monthly.csv. Variables must be of type real or double	nsegmentOutON_OFF = 1	nsegmentOutVars	4	none
nsegmentOutVars	Number of variables to include in nsegment Summary Output File(s)	nsegmentOutON_OFF = 1	1	1	0
nsegmentOut_freq	Output frequency and type (1=daily; 2=monthly; 3=both; 4=mean monthly; 5=mean yearly; 6=yearly)	nsegmentOutON_OFF = 1	1	1	1
nsub Summary Files					
nsubOutBaseFileName ²	String to define the prefix for each nsub Summary Output File.	nsubOutON_OFF = 1	1	4	none
nsubOutON_OFF	Switch to specify whether or not nsub Summary Output Files are	nsub summary results	1	1	0

Parameter name ⁴	Description	Option	Number of Values	Data type	Default value
nsubOutVar_names	generated (0=no; 1=yes) List of variable names for which output is written to nsub Summary Comma Separated Values (CSV) Output File(s). Each variable is written to a separate file with the prefix of each file equal to the value of nsubOutBaseFileName ; variables must be of type real or double. Each variable is written to a separate file with the prefix of each file equal to the value of nsubOutBaseFileName . The suffix of the files is based on the value of nsubOut_freq and will be .csv; _meanyearly.csv; _yearly.csv; _meanmonthly.csv; or _monthly.csv. Variables must be of type real or double	nsubOutON_OFF = 1	nsubOutVars	4	none
nsubOutVars	Number of variables to include in nsub Summary Output File(s)	nsubOutON_OFF = 1	1	1	0
nsubOut_freq	Output frequency and type (1=daily; 2=monthly; 3=both; 4=mean monthly; 5=mean yearly; 6=yearly)	nsubOutON_OFF = 1	1	1	1
Basin Summary Results Files					
basinOutBaseFileName ²	String to define the prefix for each Basin Summary Output File.	basinOutON_OFF = 1	1	4	none
basinOutON_OFF	Switch to specify whether or not basin Summary Output Files are generated (0=no; 1=yes)	Basin summary results	1	1	0
basinOutVar_names	List of variable names for which output is written to Basin Summary Comma Separated Values (CSV) Output File(s). Each variable is written to a separate file with the prefix of each file equal to the value of basinOutBaseFileName ; variables must be of type real or double. Each variable is written to a separate file with the prefix of each file equal to the value of basinOutBaseFileName . The suffix of the files is based on the value of basinOut_freq and will be .csv; _meanyearly.csv; _yearly.csv; _meanmonthly.csv; or _monthly.csv. Variables must be of type real or double	basinOutON_OFF = 1	basinOutVars	4	none
basinOutVars	Number of variables to include in Basin Summary Output File(s)	basinOutON_OFF = 1	1	1	0
basinOut_freq	Output frequency and type (1=daily; 2=monthly; 3=both; 4=mean monthly; 5=mean yearly; 6=yearly)	basinOutON_OFF = 1	1	1	1
Runtime graphs					
dispGraphsBuffSize	Number of time steps to wait before updating the runtime graph	ndispGraphs > 0	1	1	50
dispVar_element	List of identification numbers corresponding to variables specified in dispVar_names list (1 to variable's dimension size)	ndispGraphs > 0	number of variables	4	none
dispVar_names	List of variable names for which plots are output to the runtime graph	ndispGraphs > 0	number of variables	4	none
dispVar_plot	List of variable names for which plots are output to the runtime	ndispGraphs > 0	number of	4	none

Parameter name ⁴	Description	Option	Number of Values	Data type	Default value
executable_desc	graph Descriptive text to identify the PRMS-IV executable	ndispGraphs > 0	variables 1	4	MOWS executable
executable_model ²	Pathname (full or relative) of the PRMS-IV executable	ndispGraphs > 0	1	4	prmsIV
initial_deltat	Initial time step for the simulation	ndispGraphs > 0	1	2	24.0
ndispGraphs	Number of plots included in the runtime graph	graphical output	1	1	0

¹File and screen output options: 1=water balance output files written in current directory, for `intcp` module file `intcp.wbal`; for `snowcomp` module `snowcomp.wbal`; for `srunoff` module `srunoff_smidx.wbal` or `srunoff_carea.wbal`; for `soilzone` module `soilzone.wbal`; for `gwflow` module `gwflow.wbal`; 2=`basin` module output written to screen; 4=`basin_sum` debug information written to file `basin_sum.dbg` in current directory; 5=`soltab` module output written to the file `soltab_debug` in current directory; 7=`soilzone` debug information concerning input parameter consistency written to file `soilzone.dbg` in current directory; 9=arrays of `net_rain`, `net_snow`, and `snowmelt` written to screen; 13=`subbasin` error and warning messages and cascade paths are written to the file `cascade.msgs` in current directory; 14=`subbasin` computation order written to file `tree_structure` in current directory.

²Pathnames for all files can have a maximum of 256 characters.

³If a humidity CBH File does not exist, humidity values are specified using parameter **humidity_percent(nhru,nmonths)**.

⁴For MODFLOW-only simulations user's need only specify the **modflow_name**, **start_time**, **end_time**, **modflow_time_zero**, **init_vars_from_file**, and **save_vars_to_file** parameters.

Table 1-3. Parameters listed by usage with the associated modules in which they are used for the Precipitation-Runoff Modeling System, version 4 (PRMS-IV).

[HRU, hydrologic response unit; GWR, groundwater reservoir; cfs, cubic feet per second; cms, cubic meters per second; ET, evapotranspiration; dday, degree-day, the amount a day's average temperature departed from 65 degrees Fahrenheit; >, greater than; dimensions defined in table 1-1; control parameters **temp_module**, **precip_module**, **solrad_module**, **et_module**, **transp_module**, **srunoff_module**, **strmflow_module**, **model_mode**, **dprst_flag**, **subbasin_flag**, **cascade_flag**, **cascadegw_flag**, **humidity_day**, and **mapOutON_OFF** defined in table 1-2.

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
Basic physical attributes							
elev_units	Flag to indicate the units of elevation values (0=feet; 1=meters)	one	integer	none	0 or 1	0	required
hru_area	Area of each HRU	nhru	real	acres	0.0001 to 1.0E9	1.0	required
hru_aspect	Aspect of each HRU	nhru	real	angular degrees	0.0 to 360.0	0.0	required ⁶
hru_elev	Mean elevation for each HRU	nhru	real	elev_units	-1,000.0 to 30,000.0	0.0	required
hru_lat	Latitude of each HRU	nhru	real	degrees North	-90.0 to 90.0	40.0	required ⁶
hru_slope	Slope of each HRU	nhru	real	decimal fraction	0.0 to 10.0	0.0	required ⁶
hru_type ⁵	Type of each HRU (0=inactive; 1=land; 2=lake; 3=swale)	nhru	integer	none	0 to 3	1	required
GSFLOW module parameters (superceded GSFLOW table A1-23)							
gvr_cell_id ⁹	Index of the grid cell associated with each gravity reservoir	nhrucell	integer	none	0 to ngwcell	0	model_mode = GSFLOW or when mapOutON_OFF = 1
gvr_cell_pct ⁹	Proportion of the grid cell area associated with each gravity reservoir	nhrucell	real	decimal fraction	0.0 to 1.0	1.0	nhrucell not equal to ngwcell and either model_mode = GSFLOW or mapOutON_OFF = 1
gvr_hru_id ⁹	Index of the HRU associated with each gravity reservoir	nhrucell	integer	none	0 to nhrucell	1	nhru not equal to nhrucell and either model_mode = GSFLOW or

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
gvr_hru_pct	Proportion of the HRU area associated with each gravity reservoir	nhru cell	real	decimal fraction	0.0 to 1.0	0.0	mapOutON_OFF = 1 nhru not equal to nhru cell and model_mode = GSFLOW
id_obsrunoff	Index of measured streamflow station corresponding to the basin outlet	one	integer	none	0 to no bs	0	model_mode = GSFLOW
lake_hru_id	Identification number of the lake associated with an HRU; more than one HRU can be associated with each lake	nhru	integer	none	0 to nlake	0	required when any HRU has hru_type specified equal to 2
mxsziter	Maximum number of iterations soilzone states are computed	one	integer	none	0 to user defined	MODFLOW convergence criterion	model_mode = GSFLOW
Measured input							
outlet_sta	Index of measured streamflow station corresponding to the basin outlet	one	integer	none	0 to no bs	0	no bs > 0
precip_units	Flag to indicate the units of measured precipitation values (0=inches; 1=mm)	one	integer	none	0 or 1	0	required
rad_conv	Conversion factor to Langleys for measured solar radiation	one	real	Langleys/ radiation units	0.1 to 100.0	1.0	nsol > 0
rain_code	Monthly (January to December) flag indicating rule for precipitation measurement station use (1=only precipitation if the regression stations have precipitation; 2=only precipitation if any station in the basin has precipitation; 3=precipitation if module xyz_dist computes any; 4=only precipitation if <i>rain_day</i> variable is set to 1; 5=only precipitation if psta_freq_nuse stations have precipitation)	nmonths	integer	none	1 to 5	2	precip_module = xyz_dist
runoff_units	Measured streamflow units (0=cfs; 1=cms)	one	integer	none	0 or 1	0	no bs > 0
temp_units	Flag to indicate the units of measured air-temperature values (0=Fahrenheit; 1=Celsius)	one	integer	none	0 or 1	0	required
Air temperature and precipitation distribution							
adjmix_rain	Monthly (January to December) factor to adjust rain proportion in a mixed rain/snow event	nhru , nmonths	real	decimal fraction	0.0 to 3.0	1.0	required
adjust_rain	Monthly (January to December) rain downscaling adjustment factor for each precipitation measurement station	nrain , nmonths	real	decimal fraction	-0.5 to 0.5	-0.4	precip_module = ide_dist or xyz_dist
adjust_snow	Monthly (January to December) snow downscaling	nrain ,	real	decimal	-0.5 to 0.5	-0.4	precip_module =

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
basin_tsta	adjustment factor for each precipitation measurement station Index of temperature station used to compute basin temperature values	nmonths one	integer	fraction none	0 to ntemp	0	ide_dist or xyz_dist temp_module = temp_1sta, temp_dist2, or temp_laps
conv_flag	Elevation conversion flag (0=none; 1=feet to meters; 2=meters to feet)	one	integer	none	0 to 2	0	precip_module and temp_module = xyz_dist
dist_exp	Exponent for inverse distance calculations	one	real	none	0.0 to 10.0	2.0	precip_module and temp_module = ide_dist
dist_max	Maximum distance from an HRU to a measurement station for use in calculations	one	real	feet	0.0 to 1.0E9	1.0E9	precip_module = precip_dist2 and/or temp_module = temp_dist2
hru_plaps	Index of the lapse precipitation measurement station used for lapse rate calculations for each HRU	nhru	integer	none	0 to nrain	0	precip_module = precip_laps
hru_psta	Index of the base precipitation measurement station used for lapse rate calculations for each HRU	nhru	integer	none	0 to nrain	0	precip_module = precip_1sta or precip_laps
hru_tlaps	Index of the lapse temperature station used for lapse rate calculations	nhru	integer	none	0 to ntemp	0	temp_module = temp_laps
hru_tsta	Index of the base temperature station used for lapse rate calculations	nhru	integer	none	0 to ntemp	0	temp_module = temp_1sta or temp_laps
hru_x	Longitude (X) for each HRU in albers projection	nhru	real	meters	-1.0E7 to 1.0E7	0.0	precip_module and temp_module = ide_dist or xyz_dist
hru_xlong	Longitude of each HRU for the centroid, State Plane Coordinate System	nhru	real	feet	-1.0E9 to 1.0E9	0.0	temp_module = temp_dist2 or precip_module = precip_dist2
hru_y	Latitude (Y) for each HRU in albers projection	nhru	real	meters	-1.0E7 to 1.0E7	0.0	precip_module and temp_module = ide_dist or xyz_dist
hru_ylat	Latitude of each HRU for the centroid, State Plane	nhru	real	feet	-1.0E9 to	0.0	temp_module =

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
	Coordinate System				1.0E9		temp_dist2 and/or precip_module = precip_dist2 temp_module = temp_dist2
lapsemax_max	Monthly (January to December) maximum lapse rate to constrain lowest maximum lapse rate based on historical daily air temperatures for all air temperature-measurement stations	nmonths	real	temp_units/ feet	-3.0 to 3.0	2.0	
lapsemax_min	Monthly (January to December) maximum lapse rate to constrain lowest minimum lapse rate on the basis of historical daily air temperatures for all air temperature-measurement stations	nmonths	real	temp_units/ feet	-7.0 to -3.0	-6.5	temp_module = temp_dist2
lapsemin_max	Monthly (January to December) minimum lapse rate to constrain lowest maximum lapse rate on the basis of historical daily air temperatures for all air temperature-measurement stations	nmonths	real	temp_units/ feet	-2.0 to 4.0	3.0	temp_module = temp_dist2
lapsemin_min	Monthly (January to December) minimum lapse rate to constrain lowest minimum lapse rate on the basis of historical daily air temperatures for all air temperature-measurement stations	nmonths	real	temp_units/ feet	-7.0 to -3.0	-4.0	temp_module = temp_dist2
max_lapse	Monthly (January to December) maximum air temperature lapse rate for each direction (X, Y, and Z)	nlapse, nmonths	real	none	-100.0 to 100.0	0.0	temp_module = xyz_dist
max_missing	Maximum number of consecutive missing values allowed for any air temperature measurement station; missing value set to last valid value; 0=unlimited	one	integer	none	0 to 10	3	temp_module = temp_1sta or temp_laps
max_psta	Maximum number of precipitation measurement stations to distribute to an HRU	one	integer	none	0 to nrain	0	precip_module = precip_dist2
max_tsta	Maximum number of air temperature measurement stations to use for distributing temperature to any HRU	one	integer	none	0 to ntemp	0	temp_module = temp_dist2
maxday_prec	Maximum measured precipitation value above which precipitation is assumed to be in error	one	real	precip_units	0.0 to 20.0	15.0	precip_module = precip_dist2
min_lapse	Monthly (January to December) minimum air temperature lapse rate for each direction (X, Y, and Z)	nlapse, nmonths	real	none	-100.0 to 100.0	0.0	temp_module = xyz_dist
monmax	Monthly maximum air temperature to constrain lowest maximum air temperatures for bad values on the basis of historical temperature for all measurement stations	nmonths	real	temp_units	0.0 to 115.0	100.0	temp_module = temp_dist2
monmin	Monthly minimum air temperature to constrain lowest maximum air temperatures for bad values on the basis of historical temperature for all measurement stations	nmonths	real	temp_units	-60.0 to 65.0	-60.0	temp_module = temp_dist2
ndist_psta	Number of precipitation measure stations for inverse distance calculations	one	integer	none	0 to nrain	0	precip_module = ide_dist

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
ndist_tsta	Number of air temperature measurement stations for inverse distance calculations	one	integer	none	0 to ntemp	0	temp_module = ide_dist
padj_rn	Monthly (January to December) factor to adjust precipitation lapse rate computed between station hru_psta and station hru_plaps ; positive factors are multiplied times the lapse rate and negative factors are made positive and substituted for the computed lapse rate	nrain, nmonths	real	precip_units	-2.0 to 10.0	1.0	precip_module = precip_laps
padj_sn	Monthly (January to December) factor to adjust precipitation lapse rate computed between station hru_psta and station hru_plaps ; positive factors are multiplied times the lapse rate and negative factors are made positive and substituted for the computed lapse rate	nrain, nmonths	real	precip_units	-2.0 to 10.0	1.0	precip_module = precip_laps
pmn_mo	Mean monthly (January to December) precipitation for each lapse precipitation measurement station	nrain, nmonths	real	precip_units	0.00001 to 100.0	1.0	precip_module = precip_laps
ppt_add	Mean value for the precipitation measurement station transformation equation	one	real	precip_units	-10.0 to 10.0	0.0	precip_module = xyz_dist
ppt_div	Standard deviation for the precipitation measurement station transformation equation (not 0 . 0)	one	real	precip_units	-10.0 to 10.0	1.0	precip_module = xyz_dist
ppt_lapse	Monthly (January to December) precipitation lapse rate for each direction (X, Y, and Z)	nlapse, nmonths	real	none	-10.0 to 10.0	0.0	precip_module = xyz_dist
prcp_wght_dist	Monthly (January to December) precipitation weighting function for inverse distance calculations	nmonths	real	decimal fraction	0.0 to 1.0	0.5	precip_module = ide_dist
psta_elev	Elevation of each precipitation measurement station	nrain	real	elev_units	-300.0 to 30,000.0	0.0	precip_module = ide_dist, xyz_dist, or precip_laps
psta_freq_nuse	The subset of precipitation measurement stations used to determine if there is precipitation in the basin (0=station not used; 1=station used)	nrain	integer	none	0 or 1	1	precip_module = xyz_dist
psta_mon	Monthly (January to December) factor to precipitation at each measured station to adjust precipitation distributed to each HRU to account for differences in elevation, and so forth	nrain, nmonths	real	precip_units	0.0 to 50.0	1.0	precip_module = precip_dist2
psta_month_ppt	Average monthly (January to December) maximum precipitation at each precipitation measurement station	nrain, nmonths	real	precip_units	0.0 to 20.0	0.0	precip_module = xyz_dist
psta_nuse	The subset of precipitation measurement stations used in the distribution regression (0=station not used; 1=station used)	nrain	integer	none	0 or 1	1	precip_module = ide_dist or xyz_dist

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
psta_x	Longitude (X) for each precipitation measurement station in albers projection	nrain	real	meters	-1.0E7 to 1.0E7	0	precip_module = ide_dist or xyz_dist
psta_xlong	Longitude of each precipitation measurement station, State Plane Coordinate System	nrain	real	feet	-1.0E9 to 1.0E9	0.0	precip_module = precip_dist2
psta_y	Latitude (Y) for each precipitation measurement station in albers projection	nrain	real	meters	-1.0E7 to 1.0E7	0	precip_module = ide_dist or xyz_dist
psta_ylat	Latitude of each precipitation measurement station, State Plane Coordinate System	nrain	real	feet	-1.0E9 to 1.0E9	0.0	precip_module = precip_dist2
rain_adj	Monthly (January to December) factor to adjust measured precipitation on each HRU to account for differences in elevation, and so forth	nhru, nmonths	real	decimal fraction	0.5 to 2.5	1.0	precip_module = precip_1sta
rain_cbh_adj	Monthly (January to December) adjustment factor to measured precipitation determined to be rain on each HRU to account for differences in elevation, and so forth	nhru, nmonths	real	decimal fraction	0.5 to 2.0	1.0	precip_module = climate_hru
rain_mon	Monthly (January to December) factor to rain on each HRU to adjust precipitation distributed to each HRU to account for differences in elevation, and so forth	nhru, nmonths	real	precip_units	0.0 to 50.0	1.0	precip_module = precip_dist2
snow_adj	Monthly (January to December) factor to adjust measured precipitation on each HRU to account for differences in elevation, and so forth	nhru, nmonths	real	decimal fraction	0.5 to 2.5	1.0	precip_module = precip_1sta
snow_cbh_adj	Monthly (January to December) adjustment factor to measured precipitation determined to be snow on each HRU to account for differences in elevation, and so forth	nhru, nmonths	real	decimal fraction	0.5 to 2.0	1.0	precip_module = climate_hru
snow_mon	Monthly (January to December) factor to snow on each HRU to adjust precipitation distributed to each HRU to account for differences in elevation, and so forth	nhru, nmonths	real	precip_units	0.0 to 50.0	1.0	precip_module = precip_dist2
solrad_elev	Elevation of the solar radiation station used for the degree-day curves to distribute temperature	one	real	meters	-300.0 to 30,000.0	0.0	temp_module = ide_dist or xyz_dist
temp_wght_dist	Monthly (January to December) temperature weighting function for inverse distance calculations	nmonths	real	decimal fraction	0.0 to 1.0	0.5	temp_module = ide_dist
tmax_add	Mean value for the air-temperature measurement station transformation equation for maximum air temperature	one	real	temp_units	-100.0 to 100.0	0.0	temp_module = xyz_dist
tmax_adj	Adjustment to maximum air temperature for each HRU, estimated on the basis of slope and aspect	nhru, nmonths	real	temp_units	-10.0 to 10.0	0.0	temp_module = temp_1sta, temp_laps, temp_dist2, ide_dist or

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
tmax_allrain	Monthly (January to December) maximum air temperature when precipitation is assumed to be rain; if HRU air temperature is greater than or equal to this value, precipitation is rain	nhru, nmonths	real	temp_units	-8.0 to 75.0	38.0	xyz_dist required
tmax_allrain_dist	Monthly (January to December) maximum air temperature when precipitation is assumed to be rain; if HRU air temperature is greater than or equal to this value, precipitation is rain	nmonths	real	temp_units	-8.0 to 75.0	38.0	temp_module = xyz_dist
tmax_allrain_sta	Monthly (January to December) maximum air temperature when precipitation is assumed to be rain; if precipitation measurement air temperature is greater than or equal to this value, precipitation is rain	nrain, nmonths	real	temp_units	-8.0 to 75.0	38.0	temp_module = ide_dist
tmax_allsnow	Monthly (January to December) maximum air temperature when precipitation is assumed to be snow; if HRU air temperature is less than or equal to this value, precipitation is snow	nhru, nmonths	real	temp_units	-10.0 to 40.0	32.0	required
tmax_allsnow_dist	Maximum air temperature when precipitation is assumed to be snow; if mean air temperature is less than or equal to this value, precipitation is snow	one	real	temp_units	-10.0 to 40.0	38.0	temp_module = xyz_dist
tmax_allsnow_sta	Monthly (January to December) maximum air temperature when precipitation is assumed to be snow; if precipitation measurement air temperature is less than or equal to this value, precipitation is snow	nrain, nmonths	real	temp_units	-10.0 to 40.0	38.0	temp_module = ide_dist
tmax_cbh_adj	Monthly (January to December) adjustment factor to maximum air temperature for each HRU, estimated on the basis of slope and aspect	nhru, nmonths	real	temp_units	-10.0 to 10.0	0.0	temp_module = climate_hru
tmax_div	Standard deviation for the air-temperature-measurement station transformation equation for maximum air temperature (not 0 . 0)	one	real	temp_units	-100.0 to 100.0	1.0	temp_module = xyz_dist
tmax_lapse	Monthly (January to December) values representing the change in maximum air temperature per 1,000 elev_units of elevation change for each HRU	nhru, nmonths	real	temp_units/ elev_units	-20.0 to 20.0	3.0	temp_module = temp_1sta
tmin_add	Mean value for the air-temperature-measurement station transformation equation for minimum air temperature	one	real	temp_units	-100.0 to 100.0	0.0	temp_module = xyz_dist
tmin_adj	Adjustment to minimum air temperature for each HRU, estimated on the basis of slope and aspect	nhru, nmonths	real	temp_units	-10.0 to 10.0	0.0	temp_module = temp_1sta, temp_laps, temp_dist2, ide_dist or

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
tmin_cbh_adj	Monthly (January to December) adjustment factor to minimum air temperature for each HRU, estimated on the basis of slope and aspect	nhru, nmonths	real	temp_units	-10.0 to 10.0	0.0	xyz_dist temp_module = climate_hru
tmin_div	Standard deviation for the air-temperature-measurement station transformation equation for minimum air temperature (not 0 . 0)	one	real	temp_units	-100.0 to 100.0	1.0	temp_module = xyz_dist
tmin_lapse	Monthly (January to December) values representing the change in minimum air temperature per 1,000 elev_units of elevation change for each HRU	nhru, nmonths	real	temp_units/ elev_units	-20.0 to 20.0	3.0	temp_module = temp_1sta
tsta_elev	Elevation of each air-temperature-measurement station	ntemp	real	elev_units	-300.0 to 30,000.0	0.0	temp_module = temp_1sta, temp_dist2, temp_laps, ide_dist or xyz_dist
tsta_month_max	Average monthly (January to December) maximum air temperature at each air-temperature-measurement station	ntemp, nmonths	real	temp_units	-100.0 to 100.0	0.0	temp_module = xyz_dist
tsta_month_min	Average monthly (January to December) minimum air temperature at each air-temperature-measurement station	ntemp, nmonths	real	temp_units	-100.0 to 100.0	0.0	temp_module = xyz_dist
tsta_nuse	The subset of temperature stations used in the distribution regression (0=station not used; 1=station used)	ntemp	integer	none	0 or 1	0	temp_module = ide_dist or xyz_dist
tsta_x	Longitude (X) for each air-temperature-measurement station in albers projection	ntemp	real	meters	-1.0E7 to 1.0E7	0.0	temp_module = ide_dist or xyz_dist
tsta_xlong	Longitude of each air-temperature-measurement station, State Plane Coordinate System	ntemp	real	feet	-1.0E9 to 1.0E9	0.0	temp_module = temp_dist2
tsta_y	Latitude (Y) for each air-temperature-measurement station in albers projection	ntemp	real	meters	-1.0E7 to 1.0E7	0.0	temp_module = ide_dist or xyz_dist
tsta_ylat	Latitude of each air-temperature-measurement station, State Plane Coordinate System	ntemp	real	feet	-1.0E9 to 1.0E9	0.0	temp_module = temp_dist2
x_add	Mean value for the climate station transformation equation for the longitude (X) coordinate	one	real	meters	-1.0E7 to 1.0E7	0.0	precip_module and temp_module = xyz_dist
x_div	Standard deviation for the climate station transformation equation for the longitude (X) coordinate (not 0 . 0)	one	real	meters	-1.0E7 to 1.0E7	1.0	precip_module and temp_module = xyz_dist
y_add	Mean value for the climate station transformation	one	real	meters	-1.0E7 to	0.0	precip_module

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
	equation for the latitude (Y) coordinate				1.0E7		and temp_module
y_div	Standard deviation for the climate station transformation equation for the latitude (Y) coordinate	one	real	meters	-1.0E7 to 1.0E7	1.0	= xyz_dist precip_module and temp_module
z_add	Mean value for the climate station transformation equation for the elevation (Z) coordinate	one	real	meters	-1.0E7 to 1.0E7	0.0	= xyz_dist precip_module and temp_module
z_div	Standard deviation for the climate station transformation equation for the elevation (Z) coordinate (not 0 . 0)	one	real	meters	-1.0E7 to 1.0E7	1.0	= xyz_dist precip_module and temp_module
	Solar radiation						
basin_solsta	Index of solar radiation station used to compute basin radiation values; used when dimension nsol >0	one	integer	none	0 to nsol	0	nsol > 0
ccov_intcp	Monthly (January to December) intercept in cloud-cover relationship	nhru, nmonths	real	none	0.0 to 5.0	1.83	solrad_module = ccsolrad
ccov_slope	Monthly (January to December) coefficient in cloud-cover relationship	nhru, nmonths	real	none	-0.5 to -0.01	-0.13	solrad_module = ccsolrad
crad_coef	Coefficient(B) in Thompson (1976) equation; varies by region, contour map of values in reference	nhru, nmonths	real	none	0.1 to 0.7	0.4	solrad_module = ccsolrad
crad_exp	Exponent(P) in Thompson (1976) equation	nhru, nmonths	real	none	0.2 to 0.8	0.61	solrad_module = ccsolrad
dday_intcp	Monthly (January to December) intercept in degree-day equation for each HRU	nhru, nmonths	real	dday	-60.0 to 10.0	-40.0	solrad_module = ddsolrad
dday_slope	Monthly (January to December) slope in degree-day equation for each HRU	nhru, nmonths	real	dday/ temp_units	0.2 to 0.9	0.4	solrad_module = ddsolrad
hru_solsta	Index of solar radiation station associated with each HRU	nhru	integer	none	0 to nsol	0	nsol > 0
ppt_rad_adj	Monthly minimum precipitation, if HRU precipitation exceeds this value, radiation is multiplied by radj_sppt or radj_wppt precipitation adjustment factor	nhru, nmonths	real	inches	0.0 to 0.5	0.02	required
radadj_intcp	Monthly (January to December) intercept in air temperature range adjustment to degree-day equation for each HRU	nhru, nmonths	real	dday	0.0 to 1.0	1.0	solrad_module = ddsolrad
radadj_slope	Monthly (January to December) slope in air temperature range adjustment to degree-day equation for each HRU	nhru, nmonths	real	dday/ temp_units	0.0 to 1.0	0.0	solrad_module = ddsolrad
radj_sppt	Adjustment factor for computed solar radiation for summer day with greater than ppt_rad_adj inches precipitation for each HRU	nhru	real	decimal fraction	0.0 to 1.0	0.44	required
radj_wppt	Adjustment factor for computed solar radiation for	nhru	real	decimal	0.0 to 1.0	0.5	required

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
radmax	winter day with greater than ppt_rad_adj inches precipitation for each HRU Monthly (January to December) maximum fraction of the potential solar radiation that may reach the ground due to haze, dust, smog, and so forth, for each HRU	nhru, nmonths	real	fraction decimal fraction	0.1 to 1.0	0.8	required
tmax_index	Monthly (January to December) index temperature used to determine precipitation adjustments to solar radiation for each HRU	nhru, nmonths	real	temp_units	-10.0 to 110.0	50.0	solrad_module = ddsolrad
Potential evapotranspiration distribution							
crop_coef	Monthly (January to December) crop coefficient for each HRU	nhru, nmonths	real	decimal fraction	0.0 to 2.0	1.0	et_module = potet_pm
epan_coef	Monthly (January to December) evaporation pan coefficient for each HRU	nhru, nmonths	real	decimal fraction	0.01 to 3.0	1.0	et_module = potet_pan
hamon_coef	Monthly (January to December) air temperature coefficient used in Hamon potential ET computations for each HRU	nhru, nmonths	real	none	0.004 to 0.008	0.0055	et_module = potet_hamon
hru_humidity_sta	Index of humidity measurement station for each HRU	nhru	integer	none	0 to nhumid	0	et_module = potet_pm_sta and nhumid > 0
hru_pansta	Index of pan evaporation station used to compute HRU potential ET	nhru	integer	none	0 to nevap	0	et_module = potet_pan and nevap > 0
hru_windspeed_sta	Index of wind speed measurement station for each HRU	nhru	integer	none	0 to nwind	0	et_module = potet_pm_sta and nwind > 0
hs_krs	Monthly (January to December) adjustment factor used in Hargreaves-Samani potential ET computations for each HRU	nhru, nmonths	real	decimal fraction	0.01 to 0.24	0.0135	et_module = potet_hs
humidity_percent	Monthly humidity for each HRU	nhru, nmonths	real	percentage	0.0 to 100.0	0.0	et_module = potet_pm or potet_pt and humidity CBH File (humidity_day) is not specified
jh_coef	Monthly (January to December) air temperature coefficient used in Jensen-Haise potential ET computations for each HRU	nhru, nmonths	real	per degrees Fahrenheit	0.0 to 0.1	0.014	et_module = potet_jh
jh_coef_hru	Air temperature coefficient used in Jensen-Haise potential ET computations for each HRU	nhru	real	per degrees Fahrenheit	-99.0 to 150.0	13.0	et_module = potet_jh
lake_evap_adj	Monthly (January to December) adjustment factor for	nhru	real	decimal	0.5 to 1.0	1.0	required when any

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
	potential ET for each lake			fraction			HRU has hru_type specified equal to 2
pm_d_coef	Monthly (January to December) Penman-Monteith potential ET D wind speed coefficient for each HRU	nhru, nmonths	real	seconds/ meter	0.25 to 0.45	0.34	et_module = potet_pm
pm_n_coef	Monthly (January to December) Penman-Monteith potential ET N temperature coefficient for each HRU	nhru, nmonths	real	degrees Celsius per day	850.0 to 950.0	900.0	et_module = potet_pm
potet_cbh_adj	Monthly (January to December) adjustment factor to potential evapotranspiration specified in CBH Files for each HRU	nhru, nmonths	real	degrees decimal fraction	0.5 to 1.5	1.0	et_module = climate_hru
pt_alpha	Monthly (January to December) adjustment factor used in Priestly-Taylor potential ET computations for each HRU	nhru, nmonths	real	decimal fraction	1.0 to 2.0	1.26	et_module = potet_pt
Evapotranspiration and sublimation							
fall_frost	The solar date (number of days after winter solstice) of the first killing frost of the fall	nhru	integer	solar date	1 to 366	264	transp_module = transp_frost
frost_temp	Temperature of killing frost	nhru	real	temp_units	-10.0 to 32.0	28.0	model_mode = FROST
potet_sublim	Fraction of potential ET that is sublimated from snow in the canopy and snowpack for each HRU	nhru	real	decimal fraction	0.1 to 0.75	0.5	required
rad_trncf	Transmission coefficient for short-wave radiation through the winter vegetation canopy	nhru	real	decimal fraction	0.0 to 1.0	0.5	required
soil_type	Soil type of each HRU (1=sand; 2=loam; 3=clay)	nhru	integer	none	1 to 3	2	required
spring_frost	The solar date (number of days after winter solstice) of the last killing frost of the spring	nhru	integer	solar date	1 to 366	111	transp_module = transp_frost
transp_beg	Month to begin summing maximum air temperature for each HRU; when sum is greater than or equal to transp_tmax , transpiration begins	nhru	integer	month	1 to 12	1	transp_module = transp_tindex
transp_end	Month to stop transpiration computations; transpiration is computed thru end of previous month	nhru	integer	month	1 to 13	13	transp_module = transp_tindex
transp_tmax	Temperature index to determine the specific date of the start of the transpiration period; the maximum air temperature for each HRU is summed starting with the first day of month transp_beg ; when the sum exceeds this index, transpiration begins	nhru	real	temp_units	0.0 to 1,000.0	1.0	transp_module = transp_tindex
Interception							
cov_type	Vegetation cover type for each HRU (0=bare soil; 1=grasses; 2=shrubs; 3=trees; 4=coniferous)	nhru	integer	none	0 to 4	3	required
covden_sum	Summer vegetation cover density for the major vegetation type in each HRU	nhru	real	decimal fraction	0.0 to 1.0	0.5	required

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
covden_win	Winter vegetation cover density for the major vegetation type in each HRU	nhru	real	decimal fraction	0.0 to 1.0	0.5	required
snow_intcp	Snow interception storage capacity for the major vegetation type in each HRU	nhru	real	inches	0.0 to 1.0	0.1	required
srain_intcp	Summer rain interception storage capacity for the major vegetation type in each HRU	nhru	real	inches	0.0 to 1.0	0.1	required
wrain_intcp	Winter rain interception storage capacity for the major vegetation type in each HRU	nhru	real	inches	0.0 to 1.0	0.1	required
Snow computations							
albset_rna	Fraction of rain in a mixed precipitation event above which the snow albedo is not reset; applied during the snowpack accumulation stage	one	real	decimal fraction	0.5 to 1.0	0.8	required
albset_rnm	Fraction of rain in a mixed precipitation event above which the snow albedo is not reset; applied during the snowpack melt stage	one	real	decimal fraction	0.4 to 1.0	0.6	required
albset_sna	Minimum snowfall, in water equivalent, needed to reset snow albedo during the snowpack accumulation stage	one	real	inches	0.01 to 1.0	0.05	required
albset_snm	Minimum snowfall, in water equivalent, needed to reset snow albedo during the snowpack melt stage	one	real	inches	0.1 to 1.0	0.2	required
cecn_coef	Monthly (January to December) convection condensation energy coefficient for each HRU	nhru, nmonths	real	calories per degree Celsius > 0	0.02.0 to 20.0	5.0	required
den_init	Initial density of new-fallen snow	one	real	grams/cubic centimeters	0.01 to 0.5	0.1	required
den_max	Average maximum snowpack density	one	real	grams/cubic centimeters	0.1 to 0.8	0.6	required
emis_noppt	Average emissivity of air on days without precipitation for each HRU	nhru	real	decimal fraction	0.757 to 1.0	0.757	required
freeh2o_cap	Free-water holding capacity of snowpack expressed as a decimal fraction of the frozen water content of the snowpack (<i>pk_ice</i>) for each HRU	nhru	real	decimal fraction	0.01 to 0.2	0.05	required
hru_deplcrv	Index number for the snowpack areal depletion curve associated with each HRU	nhru	integer	none	1 to ndepl	1	required
melt_force	Julian date to force snowpack to spring snowmelt stage; varies with region depending on length of time that permanent snowpack exists for each HRU	nhru	integer	Julian day	1 to 366	140	required
melt_look	Julian date to start looking for spring snowmelt stage; varies with region depending on length of time that permanent snowpack exists for each HRU	nhru	integer	Julian day	1 to 366	90	required
settle_const	Snowpack settlement time constant	one	real	decimal	0.01 to 0.5	0.1	required

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
snarea_curve	Snow area depletion curve values, 11 values for each curve (0.0 to 1.0 in 0.1 increments)	ndeplval	real	fraction decimal	0.0 to 1.0	1.0	required
snarea_thresh	Maximum threshold snowpack water equivalent below which the snow-covered-area curve is applied; varies with elevation	nhru	real	inches	0.0 to 200.0	50.0	required
snowpack_init	Storage of snowpack in each HRU at the beginning of a simulation	nhru	real	inches	0.0 to 5000.0	0.0	required
tstorm_mo	Monthly indicator for prevalent storm type (0=frontal storms; 1=convective storms) for each HRU	nhru, nmonths	integer	none	0 or 1	0	required
Hortonian surface runoff, infiltration, and impervious storage							
carea_max	Maximum possible area contributing to surface runoff expressed as a portion of the HRU area	nhru	real	fraction decimal	0.0 to 1.0	0.6	required
carea_min	Minimum possible area contributing to surface runoff expressed as a portion of the area for each HRU	nhru	real	fraction decimal	0.0 to 1.0	0.2	srunoff_module = srunoff_carea required
hru_percent_imperv²	Fraction of each HRU area that is impervious	nhru	real	fraction decimal	0.0 to 0.999	0.0	
imperv_stor_max	Maximum impervious area retention storage for each HRU	nhru	real	inches	0.0 to 0.5	0.05	required
smidx_coef	Coefficient in non-linear contributing area algorithm for each HRU	nhru	real	decimal fraction	0.0 to 1.0	0.005	srunoff_module = srunoff_smidx
smidx_exp	Exponent in non-linear contributing area algorithm for each HRU	nhru	real	1/inch	0.0 to 1.0	0.3	srunoff_module = srunoff_smidx
snowinfil_max	Maximum snow infiltration per day for each HRU	nhru	real	inches/day	0.0 to 20.0	2.0	required
Surface depression storage							
dprst_area	Aggregate sum of surface-depression storage areas of each HRU (recommend that dprst_frac_hru be used instead of dprst_area)	nhru	real	acres	0.0 to 1.0E9	0.0	dprst_flag = 1
dprst_depth_avg	Average depth of storage depressions at maximum storage capacity	nhru	real	inches	0.0 to 500.0	132.0	dprst_flag = 1
dprst_et_coef	Fraction of unsatisfied potential evapotranspiration to apply to surface-depression storage	nhru	real	decimal fraction	0.0 to 1.0	1.0	dprst_flag = 1
dprst_flow_coef	Coefficient in linear flow routing equation for open surface depressions for each HRU	nhru	real	fraction/day	0.00001 to 0.5	0.05	dprst_flag = 1
dprst_frac_hru	Fraction of each HRU area that has surface depressions (If specified the parameter dprst_area is ignored if it also is specified)	nhru	real	decimal fraction	-1.0 to 0.999	-1.0	dprst_flag = 1
dprst_frac_init	Fraction of maximum surface-depression storage that contains water at the start of a simulation	nhru	real	decimal fraction	0.0 to 1.0	0.5	dprst_flag = 1

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
dprst_frac_open	Fraction of open surface-depression storage area within an HRU that can generate surface runoff as a function of storage volume	nhru	double	decimal fraction	0.0 to 1.0	1.0	dprst_flag = 1
dprst_seep_rate_clos	Coefficient used in linear seepage flow equation for closed surface depressions for each HRU	nhru	real	fraction/day	0.0001 to 0.1	0.02	dprst_flag = 1
dprst_seep_rate_open	Coefficient used in linear seepage flow equation for open surface depressions for each HRU	nhru	real	fraction/day	0.0001 to 0.1	0.02	dprst_flag = 1
op_flow_thres	Fraction of open depression storage above which surface runoff occurs; any water above maximum open storage capacity spills as surface runoff	nhru	real	decimal fraction	0.01 to 1.0	1.0	dprst_flag = 1
sro_to_dprst_imperv	Fraction of impervious surface runoff that flows into surface-depression storage; the remainder flows to a stream network for each HRU	nhru	real	decimal fraction	0.0 to 1.0	0.2	dprst_flag = 1
sro_to_dprst	Fraction of pervious surface runoff that flows into surface-depression storage; the remainder flows to a stream network for each HRU	nhru	real	decimal fraction	0.0 to 1.0	0.2	dprst_flag = 1
va_clos_exp	Coefficient in the exponential equation relating maximum surface area to the fraction that closed depressions are full to compute current surface area for each HRU; 0.001 is an approximate rectangle; 1.0 is a triangle	nhru	real	none	0.0001 to 10.0	0.001	dprst_flag = 1
va_open_exp	Coefficient in the exponential equation relating maximum surface area to the fraction that open depressions are full to compute current surface area for each HRU; 0.001 is an approximate rectangle; 1.0 is a triangle	nhru	real	none	0.0001 to 10.0	0.001	dprst_flag = 1
Soil zone storage, interflow, gravity drainage, dunnian surface runoff							
fastcoef_lin	Linear coefficient in equation to route preferential-flow storage downslope for each HRU	nhru	real	fraction/day	0.0 to 1.0	0.1	required ⁸
fastcoef_sq	Non-linear coefficient in equation to route preferential-flow storage downslope for each HRU	nhru	real	none	0.0 to 1.0	0.8	required ⁸
pref_flow_den	Fraction of the soil zone in which preferential flow occurs for each HRU	nhru	real	decimal fraction	0.0 to 0.5	0.0	required ⁸
sat_threshold	Water holding capacity of the gravity and preferential-flow reservoirs; difference between field capacity and total soil saturation for each HRU	nhru	real	inches	0.00001 to 999.0	999.0	required ⁸
slowcoef_lin	Linear coefficient in equation to route gravity-reservoir storage downslope for each HRU	nhru	real	fraction/day	0.0 to 1.0	0.015	required ⁸
slowcoef_sq	Non-linear coefficient in equation to route gravity-reservoir storage downslope for each HRU	nhru	real	none	0.0 to 1.0	0.1	required ⁸

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
soil_moist_init	Initial value of available water in capillary reservoir for each HRU	nhru	real	inches	0.0 to 10.0	3.0	required
soil_moist_max	Maximum available water holding capacity of capillary reservoir from land surface to rooting depth of the major vegetation type of each HRU	nhru	real	inches	0.00001 to 20.0	2.0	required
soil_rechr_init	Initial storage for soil recharge zone (upper part of capillary reservoir where losses occur as both evaporation and transpiration) for each HRU; must be less than or equal to soil_moist_init	nhru	real	inches	0.0 to 10.0	1.0	required
soil_rechr_max	Maximum storage for soil recharge zone (upper portion of capillary reservoir where losses occur as both evaporation and transpiration) of must be less than or equal to soil_moist_max	nhru	real	inches	0.00001 to 5.0	1.5	required
soil2gw_max	Maximum amount of the capillary reservoir excess that is routed directly to the GWR for each HRU	nhru	real	inches	0.0 to 5.0	0.0	required
ssr2gw_exp	Non-linear coefficient in equation used to route water from the gravity reservoirs to the GWR for each HRU	nssr	real	none	0.0 to 3.0	1.0	required
ssr2gw_rate	Linear coefficient in equation used to route water from the gravity reservoir to the GWR for each HRU	nssr	real	fraction/day	0.0001 to 1.0	0.1	required
ssstor_init	Initial storage-of the gravity and preferential-flow reservoirs for each HRU	nssr	real	inches	0.0 to 5.0	0.0	required
Groundwater flow							
gwflow_coef	Linear coefficient in the equation to compute groundwater discharge for each GWR	ngw	real	fraction/day	0.0 to 0.5	0.015	required
gwsink_coef	Linear coefficient in the equation to compute outflow to the groundwater sink for each GWR	ngw	real	fraction/day	0.0 to 1.0	0.0	required
gwstor_init	Storage in each GWR at the beginning of a simulation	ngw	real	inches	0.0 to 10.0	2.0	required
gwstor_min	Minimum storage in each GWR to ensure storage is greater than specified value to account for inflow from deep aquifers or injection wells with the water source outside the basin	ngw	real	inches	0.0 to 1.0	0.0	required
Streamflow							
hru_segment	Segment index to which an HRU contributes lateral flows (surface runoff, interflow, and groundwater discharge)	nhru	integer	none	0 to nsegment	0	strmflow_module = muskingum or strmflow_in_o ut
K_coef	Travel time of flood wave from one segment to the next downstream segment, called the Muskingum storage coefficient; enter 1 . 0 for reservoirs, diversions, and segment(s) flowing out of the basin	nsegment	real	hours	0.01 to 24.0	1.0	strmflow_module = muskingum

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
obsin_segment	Index of measured streamflow station that replaces inflow to a segment	nsegment	integer	none	0 to nobs	0	strmflow_module = muskingum or strmflow_in_o ut
segment_flow_init	Initial flow in each stream segment	nsegment	real	cfs	0 to 1.0E7	0.0	strmflow_module = muskingum or strmflow_in_o ut
tosegment	Index of downstream segment to which the segment streamflow flows; for segments that do not flow to another segment enter 0	nsegment	integer	none	0 to nsegment	0	strmflow_module = muskingum or strmflow_in_o ut
x_coef	The amount of attenuation of the flow wave, called the Muskingum routing weighting factor; enter 0.0 for reservoirs, diversions, and segment(s) flowing out of the basin	nsegment	real	decimal fraction	0.0 to 0.5	0.2	strmflow_module = muskingum
Output options							
print_freq	Flag to select the output frequency; for combinations, add index numbers, e.g., daily plus yearly = 10; yearly plus total = 3 (0=none; 1=run totals; 2=yearly; 4=monthly; 8=daily; or additive combinations)	one	integer	none	0 to 15	3	required
print_type	Flag to select the type of results written to the output file (0=measured and simulated flow only; 1=water balance table; 2=detailed output)	one	integer	none	0 to 2	1	required
prms_warmup	Number of years to simulate before writing mapped results or nhru Summary Output	one	integer	years	0 to user defined	1	mapOutON_OFF = 1 or nhruOutON_OFF = 1
Subbasin parameters							
hru_subbasin	Index of subbasin assigned to each HRU	nhru	integer	none	0 to user defined	0	subbasin_flag = 1
subbasin_down	Index number for the downstream subbasin whose inflow is outflow from this subbasin	nsub	integer	none	0 to nsub	0	subbasin_flag = 1
Mapped results parameters							
mapvars_freq	Flag to specify the output frequency (0=none; 1=monthly; 2=yearly; 3=total; 4=monthly and yearly; 5=monthly, yearly, and total; 6=weekly; 7=daily)	one	integer	none	0 to 7	0	mapOutON_OFF = 1
mapvars_units	Flag to specify the output units of mapped results (0=units of the variable; 1=inches to feet; 2=inches to	one	integer	none	0 to 3	0	mapOutON_OFF = 1

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
ncol	centimeters; 3=inches to meters; as states or fluxes) Number of columns for each row of the mapped results	one	integer	none	1 to 50000	1	mapOutON_OFF = 1
Parameters for cascading-flow simulation							
cascade_flg	Flag to indicate cascade type (0=allow many to many; 1=force one to one)	one	integer	none	0 or 1	0	cascade_flag = 1 and ncascade > 0 and/or cascadegw_flag = 1 ncascdgw > 0
cascade_tol	Cascade area below which a cascade link is ignored	one	real	acres	0.0 to 0.75% of hru_area	5.0	cascade_flag = 1 and ncascade > 0 and/or cascadegw_flag = 1 ncascdgw > 0
circle_switch	Switch to check for circles (0=no check; 1=check)	one	integer	none	0 or 1	1	cascade_flag = 1 and ncascade > 0 and/or cascadegw_flag = 1 ncascdgw > 0
gw_down_id ³	Index number of the downslope GWR to which the upslope GWR contributes flow	ncascdgw	integer	none	0 to ngw	0	cascadegw_flag = 1 and ncascdgw > 0
gw_pct_up	Fraction of GWR area used to compute flow contributed to a downslope GWR or stream segment for cascade area	ncascdgw	real	decimal fraction	0.0 to 1.0	1.0	cascadegw_flag = 1 and ncascdgw > 0
gw_strmseg_down_id	Index number of the stream segment that cascade area contributes flow	ncascdgw	integer	none	0 to nsegment	0	cascadegw_flag = 1 and ncascdgw > 0
gw_up_id	Index of GWR containing cascade area	ncascdgw	integer	none	1 to ngw	0	cascadegw_flag = 1 and ncascdgw > 0
hru_down_id ⁴	Index number of the downslope HRU to which the upslope HRU contributes flow	ncascade	integer	none	0 to nhru	0	cascade_flag = 1 and ncascade > 0
hru_pct_up	Fraction of HRU area used to compute flow contributed to a downslope HRU or stream segment for cascade area	ncascade	real	decimal fraction	0.0 to 1.0	1.0	cascade_flag = 1 and ncascade > 0
hru_strmseg_down_id	Index number of the stream segment that cascade area contributes flow	ncascade	integer	none	0 to nsegment	0	cascade_flag = 1 and ncascade > 0
hru_up_id	Index of HRU containing cascade area	ncascade	integer	none	0 to nhru	0	cascade_flag = 1

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
							and ncascade > 0

¹Dimensions defined in table 1-1.

³ If the value of **gw_strmseg_down_id**>0 for cascade link, this value is ignored.

⁴If the value of **hru_strmseg_down_id**>0 for cascade link, this value is ignored.

⁵Parameter can be modified if the code determines an HRU is a swale, based on values of the cascade parameters.

⁹Parameter name is based on parameter of same name specified for the Groundwater and Surface-Water Flow (GSFLOW) model (Markstrom and others, 2008).

Only required if the HRU map is different than the target map, that is, dimension **nhru** not equal to **ngwcell**.

Table 1-4. Time-series input variables that may be included in the Data File for the Precipitation-Runoff Modeling System, version 4 (PRMS-IV).

[cfs, cubic feet per second; cms, cubic meters per second; **runoff_units**, 0=cfs; 1=cms; **precip_units**, 0=inches; 1=millimeters; **temp_units**, 0=degrees Fahrenheit; 1=degrees Celsius; >=, greater than or equal to]

Variable	Definition	Units	Valid range	Dimension ¹
<i>humidity</i>	Relative humidity at each measurement station	percentage	0 . 0 to 1 . 0	nhumid
<i>pan_evap</i>	Pan evaporation at each measurement station	inches	>=0 . 0	nevap
<i>precip</i>	Precipitation at each measurement station	precip_units	>=0 . 0	nrain
<i>rain_day</i>	Flag to set the form of any precipitation to rain (0=determine form; 1=rain)	none	0 or 1	one
<i>runoff</i>	Streamflow at each measurement station	runoff_units	>=0 . 0	nobs
<i>snowdepth</i>	Snow depth at each measurement station	inches	>=0 . 0	nsnow
<i>solrad</i>	Solar radiation at each measurement station	Langleys	>=0 . 0	nsol
<i>tmax</i>	Maximum air temperature at each measurement station	temp_units	-99 . 0 to 150 . 0	ntemp
<i>tmin</i>	Minimum air temperature at each measurement station	temp_units	-99 . 0 to 150 . 0	ntemp
<i>wind_speed</i>	Wind speed at each measurement station	miles per hour	0 . 0 to 500 . 0	nwind

¹Dimensions defined in table 1-1.

Table 1-5. Input and output variables for the Precipitation-Runoff Modeling System, version 4 (PRMS-IV).

[HRU, hydrologic response unit; GWR, groundwater reservoir; CBH, climate-by-HRU; ET, evapotranspiration; cfs: cubic feet per second; cms: cubic meters per second; >, greater than; **runoff_units**, 0=cfs; 1=cms; **precip_units**, 0=inches; 1=millimeters; **temp_units**, 0=degrees Fahrenheit; 1=degrees Celsius; control parameters **temp_module**, **precip_module**, **et_module**, **strmflow_module**, **model_mode**, **dprst_flag**, **subbasin_flag**, **cascade_flag**, and **cascadegw_flag** defined in table 1-2]

Variable name	Description	Dimension ¹	Units	Data type	Availabilty/condition
Climate distribution					
<i>basin_lakeprecip</i>	Basin area-weighted average precipitation on lake HRUs	one	inches	double	nlake > 0
<i>basin_lapse_max</i>	Basin area-weighted average maximum air temperature lapse rate per 1,000 feet	one	temp_units / feet	real	temp_module = temp_dist2
<i>basin_lapse_min</i>	Basin area-weighted average minimum air temperature lapse rate per 1,000 feet	one	temp_units / feet	real	temp_module = temp_dist2
<i>basin_max_temp_mo</i>	Monthly basin area-weighted average maximum air temperature	one	temp_units	double	always
<i>basin_max_temp_tot</i>	Total simulation basin area-weighted average maximum air temperature	one	temp_units	double	always
<i>basin_max_temp_yr</i>	Yearly basin area-weighted average maximum air temperature	one	temp_units	double	always
<i>basin_min_temp_mo</i>	Monthly basin area-weighted average minimum air temperature	one	temp_units	double	always
<i>basin_min_temp_tot</i>	Total simulation basin area-weighted average minimum air temperature	one	temp_units	double	always
<i>basin_min_temp_yr</i>	Yearly basin area-weighted average minimum air temperature	one	temp_units	double	always
<i>basin_net_ppt</i>	Basin area-weighted average throughfall	one	inches	double	always
<i>basin_net_ppt_mo</i>	Monthly basin area-weighted average net precipitation	one	inches	double	always
<i>basin_net_ppt_yr</i>	Yearly basin area-weighted average net precipitation	one	inches	double	always
<i>basin_obs_ppt</i>	Basin area-weighted measured average precipitation	one	inches	double	always
<i>basin_ppt</i>	Basin area-weighted average precipitation	one	inches	double	always
<i>basin_ppt_mo</i>	Monthly basin area-weighted average precipitation	one	inches	double	always
<i>basin_ppt_tot</i>	Total simulation basin area-weighted average precipitation	one	inches	double	always
<i>basin_ppt_yr</i>	Yearly basin area-weighted average precipitation	one	inches	double	always
<i>basin_rain</i>	Basin area-weighted average rainfall	one	inches	double	always
<i>basin_snow</i>	Basin area-weighted average snowfall	one	inches	double	always
<i>basin_temp</i>	Basin area-weighted average air temperature	one	temp_units	double	always
<i>basin_tmax</i>	Basin area-weighted maximum air temperature	one	temp_units	double	always
<i>basin_tmin</i>	Basin area-weighted minimum air temperature	one	temp_units	double	always
<i>hru_ppt</i>	Precipitation distributed to each HRU	nhru	inches	real	always
<i>hru_rain</i>	Rain distributed to each HRU	nhru	inches	real	always
<i>hru_snow</i>	Snow distributed to each HRU	nhru	inches	real	always

<i>humidity</i>	Relative humidity at each measurement station	nhumid	percentage	real	nhumid > 0
<i>humidity_hru</i>	Relative humidity for each HRU	nhru	percentage	real	et_module = potet_pm or potet_pt
<i>is_rain_day</i>	Flag to indicate if it is raining anywhere in the basin	one	none	integer	precip_module = xyz_dist
<i>net_ppt</i>	Precipitation (rain and/or snow) that falls through the canopy for each HRU	nhru	inches	real	always
<i>net_rain</i>	Rain that falls through canopy for each HRU	nhru	inches	real	always
<i>net_snow</i>	Snow that falls through canopy for each HRU	nhru	inches	real	always
<i>newsnow²</i>	Flag to indicate if new snow fell on each HRU (0=no; 1=yes)	nhru	none	integer	always
<i>pptmix²</i>	Flag to indicate if precipitation is a mixture of rain and snow for each HRU (0=no; 1=yes)	nhru	none	integer	always
<i>precip</i>	Precipitation at each measurement station	nrain	precip_units	real	nrain > 0
<i>prmx</i>	Fraction of rain in a mixed precipitation event for each HRU	nhru	decimal fraction	real	always
<i>rain_day</i>	Flag to set the form of any precipitation to rain (0=determine form; 1=rain)	one	none	integer	precip_module = xyz_dist
<i>subinc_precip</i>	Area-weighted average precipitation on associated HRUs to each subbasin	nsb	inches	double	subbasin_flag = 1
<i>subinc_rain</i>	Area-weighted average rain from associated HRUs to each subbasin	nsb	inches	double	subbasin_flag = 1
<i>subinc_snow</i>	Area-weighted average snow on associated HRUs to each subbasin	nsb	inches	double	subbasin_flag = 1
<i>subinc_tavgc</i>	Area-weighted average air temperature for associated HRUs to each subbasin	nsb	degrees Celsius	double	subbasin_flag = 1
<i>subinc_tmaxc</i>	Area-weighted average maximum air temperature for associated HRUs to each subbasin	nsb	degrees Celsius	double	subbasin_flag = 1
<i>subinc_tminc</i>	Area-weighted average minimum air temperature for associated HRUs to each subbasin	nsb	degrees Celsius	double	subbasin_flag = 1
<i>tavgc</i>	Average air temperature distributed to each HRU	nhru	degrees Celsius	real	always
<i>tavgf</i>	Average air temperature distributed to each HRU	nhru	degrees Fahrenheit	real	always
<i>tmax</i>	Maximum air temperature at each measurement station	ntemp	temp_units	real	ntemp > 0
<i>tmax_rain_sta</i>	Maximum air temperature distributed to the precipitation stations	nrain	degrees Fahrenheit	real	precip_module = ide_dist or xyz_dist
<i>tmaxc</i>	Maximum air temperature distributed to each HRU	nhru	degrees Celsius	real	always
<i>tmaxf</i>	Maximum air temperature distributed to each HRU	nhru	degrees Fahrenheit	real	always
<i>tmin</i>	Minimum air temperature at each measurement station	ntemp	temp_units	real	ntemp > 0
<i>tmin_rain_sta</i>	Minimum air temperature distributed to the precipitation measurement stations	nrain	degrees Fahrenheit	real	precip_module = ide_dist or xyz_dist
<i>tminc</i>	Minimum air temperature distributed to each HRU	nhru	degrees Celsius	real	always
<i>tminf</i>	Minimum air temperature distributed to each HRU	nhru	degrees Fahrenheit	real	always

<i>wind_speed</i>	Wind speed at each measurement station	nwind	miles per hour	real	nwind > 0
<i>wind_speed_hru</i>	Wind speed for each HRU	nhru	miles per hour	real	et_module = potet_pm or potet_pm_sta
Solar radiation distribution					
<i>basin_cloud_cover</i>	Basin area-weighted average cloud cover proportion	one	decimal fraction	double	solrad_module = ccsolrad
<i>basin_horad</i>	Potential shortwave radiation for the basin centroid	one	Langleys	double	always
<i>basin_orad</i>	Basin area-weighted average shortwave radiation on a horizontal surface	one	Langleys	double	solrad_module = ccsolrad or ddsolrad
<i>basin_potsw</i>	Basin area-weighted average shortwave radiation	one	Langleys	double	always
<i>basin_radadj</i>	Basin area-weighted average potential radiation adjustment for cloud cover	one	decimal fraction	double	solrad_module = ccsolrad
<i>basin_swrad</i>	Basin area-weighted average shortwave radiation	one	Langleys	double	always
<i>cloud_cover_hru</i>	Cloud cover proportion of each HRU	nhru	decimal fraction	double	solrad_module = ccsolrad
<i>cloud_radadj</i>	Radiation adjustment for cloud cover of each HRU	nhru	decimal fraction	double	solrad_module = ccsolrad
<i>lwrad_net</i>	Net long-wave radiation for each HRU	nhru	Megajoules/m**2/day	real	et_module = potet_pm, potet_pm_sta or potet_pt
<i>orad</i>	Measured or computed solar radiation on a horizontal surface	one	Langleys	real	solrad_module = ccsolrad or ddsolrad
<i>orad_hru</i>	Solar radiation on a horizontal surface for each HRU	one	Langleys	double	solrad_module = ccsolrad or ddsolrad
<i>seginc_swrad</i>	Area-weighted average solar radiation for each segment from HRUs contributing flow to the segment	nsegment	Langleys	double	nsegment > 0
<i>solrad</i>	Solar radiation at each measurement station	nsol	Langleys	real	nsol > 0
<i>solrad_tmax</i> ⁵	Basin maximum air temperature for use with solar radiation calculations	one	temp_units	real	always
<i>solrad_tmin</i> ⁵	Basin minimum air temperature for use with solar radiation calculations	one	temp_units	real	always
<i>soltab_horad_potsw</i>	Potential solar radiation on a horizontal plane for each Julian Day, for each HRU	ndays, nhru	Langleys	double	always
<i>soltab_potsw</i>	Potential solar radiation for each Julian Day, for each HRU	ndays, nhru	Langleys	double	always
<i>subinc_swrad</i>	Area-weighted average shortwave radiation distributed to associated HRUs of each subbasin	nsol	Langleys	double	subbasin_flag = 1
<i>swrad</i>	Shortwave radiation distributed to each HRU	nhru	Langleys	real	always

Interception

<i>basin_intcp_stor</i>	Basin area-weighted average interception storage	one	inches	double	always
<i>basin_net_rain</i>	Basin area-weighted average rain throughfall	one	inches	double	always
<i>basin_net_snow</i>	Basin area-weighted average snow throughfall	one	inches	double	always
<i>canopy_covden</i>	Canopy cover density fo each HRU	nhru	decimal fraction	real	always
<i>hru_intcpstor</i>	Interception storage in the canopy for each HRU	nhru	inches	real	always
<i>intcp_form</i>	Form (rain or snow) of interception for each HRU	nhru	none	integer	always
<i>intcp_on</i>	Flag indicating interception storage for each HRU (0=no; 1=yes)	nhru	none	integer	always
<i>intcp_stor</i>	Interception storage in canopy for cover density for each HRU	nhru	inches	real	always
Snow computations					
<i>ai</i>	Maximum snowpack for each HRU	nhru	inches	real	always
<i>albedo</i>	Snow surface albedo or the fraction of radiation reflected from the snowpack surface for each HRU	nhru	decimal fraction	real	always
<i>basin_pk_precip</i>	Basin area-weighted average precipitation added to snowpack	one	inches	double	always
<i>basin_pweqv</i>	Basin area-weighted average snowpack water equivalent	one	inches	double	always
<i>basin_snowcov</i>	Basin area-weighted average snow-covered area	one	decimal fraction	double	always
<i>basin_snowdepth</i>	Basin area-weighted average snow depth	one	inches	double	always
<i>basin_snowevap</i>	Basin area-weighted average evaporation and sublimation from snowpack	one	inches	double	always
<i>basin_snowmelt</i>	Basin area-weighted average snowmelt	one	inches	double	always
<i>basin_snowmelt_mo</i>	Monthly basin area-weighted average snowmelt	one	inches	double	always
<i>basin_snowmelt_tot</i>	Total simulation basin area-weighted average snowmelt	one	inches	double	always
<i>basin_snowmelt_yr</i>	Yearly basin area-weighted average snowmelt	one	inches	double	always
<i>basin_tcal</i>	Basin area-weighted average net snowpack energy balance	one	Langleys	double	always
<i>frac_swe</i>	Fraction of maximum snow-water equivalent (snarea_thresh) on each HRU	nhru	decimal fraction	real	always
<i>freeh2o</i>	Storage of free liquid water in the snowpack on each HRU	nhru	inches	real	always
<i>iasw</i>	Flag indicating that snow covered area is interpolated between previous location on curve and maximum (1), or is on the defined curve (0)	nhru	none	integer	always
<i>int_alb</i>	Flag to indicate (1: accumulation season curve; 2: use of the melt season curve)	nhru	none	integer	always
<i>iso</i>	Flag to indicate if time is before (1) or after (2) the day to force melt season (melt_force)	nhru	none	integer	always
<i>lso</i>	Counter for tracking the number of days the snowpack is at or above 0 degrees Celsius	nhru	number of iterations	integer	always
<i>lst</i>	Flag indicating whether there was new snow that was insufficient to reset the albedo curve (1) (albset_snm or albset_sna), otherwise (0)	nhru	none	integer	always
<i>mso</i>	Flag to indicate if time is before (1) or after (2) the first potential day for melt season (melt_look)	nhru	none	integer	always

<i>pk_def</i>	Heat deficit, amount of heat necessary to make the snowpack isothermal at 0 degrees Celsius	nhru	Langleys	real	always
<i>pk_den</i>	Density of the snowpack on each HRU	nhru	grams/cubic centimeters	real	always
<i>pk_depth</i>	Depth of snowpack on each HRU	nhru	inches	double	always
<i>pk_ice</i>	Storage of frozen water in the snowpack on each HRU	nhru	inches	real	always
<i>pk_precip</i>	Precipitation added to snowpack for each HRU	nhru	inches	real	always
<i>pk_temp</i>	Temperature of the snowpack on each HRU	nhru	temp_units	real	always
<i>pksv</i>	Snowpack water equivalent when there is new snow and in melt phase; used to interpolate between depletion curve and 100 percent on each HRU	nhru	inches	real	always
<i>pkwater_ante</i>	Antecedent snowpack water equivalent on each HRU	nhru	inches	double	always
<i>pkwater_equiv</i>	Snowpack water equivalent on each HRU	nhru	inches	double	always
<i>pptmix_nopack</i>	Flag indicating that a mixed precipitation event has occurred with no snowpack present on an HRU (1), otherwise (0)	nhru	none	integer	always
<i>pss</i>	Previous snowpack water equivalent plus new snow	nhru	inches	real	always
<i>pst</i>	While a snowpack exists, <i>pst</i> tracks the maximum snow water equivalent of that snowpack	nhru	inches	real	always
<i>salb</i>	Days since last new snow to reset albedo for each HRU	nhru	days	real	always
<i>scrsv</i>	Snowpack water equivalent plus a portion of new snow on each HRU	nhru	inches	double	always
<i>slst</i>	Days since last new snow for each HRU	nhru	days	real	always
<i>snow_evap</i>	Evaporation and sublimation from snowpack on each HRU	nhru	inches	real	always
<i>snow_free</i>	Fraction of snow-free surface for each HRU	nhru	decimal fraction	real	always
<i>snowcov_area</i>	Snow-covered area on each HRU prior to melt and sublimation unless snowpack depleted	nhru	decimal fraction	real	always
<i>snowcov_areasy</i>	Snow cover fraction when there is new snow and in melt phase; used to interpolate between depletion curve and 100 percent on each HRU	nhru	decimal fraction	real	always
<i>snowdepth</i>	Snow depth at each measurement station	nhru	inches	real	always
<i>snowmelt</i>	Snowmelt from snowpack on each HRU	nhru	inches	real	always
<i>snsy</i>	Tracks the cumulative amount of new snow until there is enough to reset the albedo curve (albset_snm or albset_sna)	nhru	inches	real	always
<i>subinc_pkweqv</i>	Area-weighted average snowpack water equivalent from associated HRUs of each subbasin	nsub	inches	double	subbasin_flag = 1
<i>subinc_snowcov</i>	Area-weighted average snow-covered area from associated HRUs to each subbasin	nsub	decimal fraction	double	subbasin_flag = 1
<i>subinc_snowmelt</i>	Area-weighted average snowmelt from associated HRUs of each subbasin	nsub	inches	double	subbasin_flag = 1
<i>tcal</i>	Net snowpack energy balance on each HRU	nhru	Langleys	real	always

Evapotranspiration						
<i>basin_actet</i>	Basin area-weighted average actual ET	one	inches	double	always	
<i>basin_actet_mo</i>	Monthly basin area-weighted average actual ET	one	inches	double	always	
<i>basin_actet_tot</i>	Total simulation basin area-weighted average actual ET	one	inches	double	always	
<i>basin_actet_yr</i>	Yearly basin area-weighted average actual ET	one	inches	double	always	
<i>basin_dprst_evap</i>	Basin area-weighted average evaporation from surface depression storage	one	inches	double	dprst_flag = 1	
<i>basin_humidity</i>	Basin area-weighted average average humidity	one	percentage	double	et_module = potet_pm, potet_pm_sta, or potet_pt	
<i>basin_imperv_evap</i>	Basin area-weighted average evaporation from impervious area	one	inches	double	always	
<i>basin_intcp_evap</i>	Basin area-weighted evaporation from the canopy	one	inches	double	always	
<i>basin_intcp_evap_mo</i>	Monthly basin basin area-weighted average interception evaporation	one	inches	double	always	
<i>basin_intcp_evap_tot</i>	Total simulation basin basin area-weighted average interception evaporation	one	inches	double	always	
<i>basin_intcp_evap_yr</i>	Yearly basin basin area-weighted average interception evaporation	one	inches	double	always	
<i>basin_lakeevap</i>	Basin area-weighted average lake evaporation	one	inches	double	nlake > 0	
<i>basin_perv_et</i>	Basin area-weighted average ET from capillary reservoirs	one	inches	double	always	
<i>basin_potet</i>	Basin area-weighted average potential ET	one	inches	double	always	
<i>basin_potet_mo</i>	Monthly area-weighted average potential ET	one	inches	double	always	
<i>basin_potet_tot</i>	Total simulation area-weighted average potential ET	one	inches	double	always	
<i>basin_potet_yr</i>	Yearly area-weighted average potential ET	one	inches	double	always	
<i>basin_swale_et</i>	Basin area-weighted average ET from swale HRUs	one	inches	double	always	
<i>basin_transp_on</i>	Flag indicating whether transpiration is occurring anywhere in the basin (0=no; 1=yes)	one	none	integer	always	
<i>basin_windspeed</i>	Basin area-weighted average average wind speed	one	decimal fraction	double	et_module = potet_pm or potet_pm_sta	
<i>dprst_evap_hru</i>	Evaporation from surface-depression storage for each HRU	nhru	inches	real	dprst_flag = 1	
<i>hru_actet</i>	Actual ET for each HRU	nhru	inches	real	always	
<i>hru_et_yr</i>	Yearly area-weighted average actual ET for each HRU	nhru	inches	double	print_freq = 2	
<i>hru_impoervevap</i>	HRU area-weighted average evaporation from impervious area for each HRU	nhru	inches	real	always	
<i>hru_intcpevap</i>	Evaporation from the canopy for each HRU	nhru	inches	real	always	
<i>imperv_evap</i>	Evaporation from impervious area for each HRU	nhru	inches	real	always	
<i>intcp_evap</i>	Evaporation from the canopy for each HRU	nhru	inches	real	always	
<i>pan_evap</i>	Pan evaporation at each measurement station	nevap	inches	real	nevap > 0	
<i>perv_actet</i>	Actual ET from the capillary reservoir of each HRU	nhru	inches	real	always	

<i>potet</i>	Potential ET for each HRU	nhru	inches	real	always
<i>potet_lower</i>	Potential ET in the lower zone of the capillary reservoir for each HRU	nhru	inches	real	always
<i>potet_rechr</i>	Potential ET in the recharge zone of the capillary reservoir for each HRU	nhru	inches	real	always
<i>seginc_potet</i>	Area-weighted average potential ET for each segment from HRUs contributing flow to the segment	nsegment	inches	double	strmflow_module = muskingum or strmflow_in_out
<i>subinc_actet</i>	Area-weighted average actual ET from associated HRUs to each subbasin	nsub	inches	double	subbasin_flag = 1
<i>subinc_potet</i>	Area-weighted average potential ET from associated HRUs to each subbasin	nsub	inches	double	subbasin_flag = 1
<i>swale_actet</i>	Evaporation from the gravity and preferential-flow reservoirs that exceeds sat_threshold	nhru	inches	real	always
<i>tempc_dewpt</i>	air temperature at dew point for each HRU	nhru	degrees Celsius	real	et_module = potet_pm, potet_pm_sta, or potet_pt
<i>transp_on</i>	Flag indicating whether transpiration is occurring (0=no; 1=yes)	nhru	none	integer	always
<i>unused_potet</i>	Unsatisfied potential evapotranspiration	nhru	inches	real	always
<i>vp_actual</i>	Actual vapor pressure for each HRU	nhru	kilopascals	real	et_module = potet_pm, potet_pm_sta, or potet_pt
<i>vp_sat</i>	Saturation vapor pressure for each HRU	nhru	kilopascals	real	et_module = potet_pm or potet_pm_sta
<i>vp_slope</i>	Slope of saturation vapor pressure versus air temperature curve for each HRU	nhru	kilopascals/degrees Celsius	real	et_module = potet_pm, potet_pm_sta, or potet_pt
Hortonian surface runoff, infiltration, and impervious storage					
<i>basin_cap_infil_tot</i>	Basin area-weighted average infiltration with cascading flow into capillary reservoirs	one	inches	double	always
<i>basin_contrib_fraction</i>	Basin area-weighted average contributing area of the pervious area of each HRU	one	decimal fraction	double	always
<i>basin_hortonian</i>	Basin area-weighted average Hortonian runoff	one	inches	double	always
<i>basin_hortonian_lakes</i>	Basin area-weighted average Hortonian surface runoff to lakes	one	inches	double	cascade_flag = 1 and ncascade > 0
<i>basin_imperv_stor</i>	Basin area-weighted average storage on impervious area	one	inches	double	always
<i>basin_infil</i>	Basin area-weighted average infiltration to the capillary reservoirs	one	inches	double	always
<i>basin_sroff</i>	Basin area-weighted average surface runoff to the stream network	one	inches	double	always
<i>basin_sroff_cfs</i>	Basin area-weighted average surface runoff to the stream network	one	cfs	double	always

<i>basin_sroff_down</i>	Basin area-weighted average cascading surface runoff	one	inches	double	cascade_flag = 1 and ncascade > 0
<i>basin_sroff_mo</i>	Monthly basin area-weighted average surface runoff	one	inches	double	always
<i>basin_sroff_tot</i>	Total simulation basin area-weighted average surface runoff	one	inches	double	always
<i>basin_sroff_upslope</i>	Basin area-weighted average cascading surface runoff received from upslope HRUs	one	inches	double	cascade_flag = 1 and ncascade > 0
<i>basin_sroff_yr</i>	Yearly basin area-weighted average surface runoff	one	inches	double	always
<i>basin_sroffi</i>	Basin area-weighted average surface runoff from impervious areas	one	inches	double	always
<i>basin_sroffp</i>	Basin area-weighted average surface runoff from pervious areas	one	inches	double	always
<i>contrib_fraction</i>	Contributing area of each HRU pervious area	nhru	decimal fraction	real	always
<i>hortonian_flow</i>	Hortonian surface runoff reaching stream network for each HRU	nhru	inches	real	always
<i>hortonian_lakes</i>	Surface runoff to lakes for each HRU	nhru	inches	double	cascade_flag = 1, ncascade > 0, and nlake > 0
<i>hru_frac_perv</i>	Fraction of HRU that is pervious	nhru	decimal fraction	real	always
<i>hru_hortn_cascflow</i>	Cascading Hortonian surface runoff leaving each HRU	nhru	inches	double	cascade_flag = 1 and ncascade > 0
<i>hru_imperv</i>	Area of HRU that is impervious	nhru	acres	real	always
<i>hru_impervstor</i>	Storage on impervious area for each HRU	nhru	inches	real	always
<i>hru_perv</i>	Area of HRU that is pervious	nhru	acres	real	always
<i>hru_sroffi</i>	Surface runoff from impervious areas for each HRU	nhru	inches	real	always
<i>hru_sroffp</i>	Surface runoff from pervious areas for each HRU	nhru	inches	real	always
<i>imperv_stor</i>	Storage on impervious area for each HRU	nhru	inches	real	always
<i>infil</i>	Infiltration to the capillary reservoir for each HRU	nhru	inches	real	always
<i>seginc_sroff</i>	Area-weighted average surface runoff for each segment from HRUs contributing flow to the segment	nsegment	cfs	double	nsegment > 0
<i>sroff^s</i>	Surface runoff to the stream network for each HRU	nhru	inches	real	always
<i>sub_sroff</i>	Area-weighted average Hortonian plus Dunnian surface runoff from associated HRUs to each subbasin and from upstream subbasins	nsb	cfs	double	subbasin_flag = 1
<i>subinc_sroff</i>	Area-weighted average Hortonian plus Dunnian surface runoff from associated HRUs to each subbasin	nsb	cfs	double	subbasin_flag = 1
<i>upslope_hortonian</i>	Hortonian surface runoff received from upslope HRUs	nhru	inches	double	cascade_flag = 1 and ncascade > 0
Surface depression storage					
<i>basin_dprst_seep</i>	Basin area-weighted average seepage surface-depression storage	one	inches	double	dprst_flag = 1
<i>basin_dprst_sroff</i>	Basin area-weighted average surface runoff from open surface-depression storage	one	inches	double	dprst_flag = 1
<i>basin_dprst_volcl</i>	Basin area-weighted average storage volume in closed surface	one	inches	double	dprst_flag = 1

<i>basin_dprst_volop</i>	depressions Basin area-weighted average storage volume in open surface	one	inches	double	dprst_flag = 1
<i>dprst_area_clos</i>	depressions Surface area of closed surface depressions based on volume for each HRU	nhru	acres	real	dprst_flag = 1
<i>dprst_area_clos_max</i>	Aggregate sum of closed surface-depression storage areas of each HRU	nhru	acres	real	dprst_flag = 1
<i>dprst_area_max</i>	Aggregate sum of surface-depression storage areas of each HRU	nhru	acres	real	dprst_flag = 1
<i>dprst_area_open</i>	Surface area of open surface depressions based on volume for each HRU	nhru	acres	real	dprst_flag = 1
<i>dprst_area_open_max</i>	Aggregate sum of open surface-depression storage areas of each HRU	nhru	acres	real	dprst_flag = 1
<i>dprst_insroff_hru</i>	Surface runoff from pervious and impervious portions into surface depression storage for each HRU	nhru	inches	real	dprst_flag = 1
<i>dprst_seep_hru</i>	Seepage from surface-depression storage to associated GWR for each HRU	nhru	inches	double	dprst_flag = 1
<i>dprst_sroff_hru</i>	Surface runoff from open surface-depression storage for each HRU	nhru	inches	double	dprst_flag = 1
<i>dprst_stor_hru</i>	Surface-depression storage for each HRU	nhru	inches	double	dprst_flag = 1
<i>dprst_vol_clos</i>	Storage volume in closed surface depressions for each HRU	nhru	acre-inches	double	dprst_flag = 1
<i>dprst_vol_clos_frac</i>	Fraction of closed surface-depression storage of the maximum storage for each HRU	nhru	decimal fraction	double	dprst_flag = 1
<i>dprst_vol_frac</i>	Fraction of surface-depression storage of the maximum storage for each HRU	nhru	decimal fraction	double	dprst_flag = 1
<i>dprst_vol_open</i>	Storage volume in open surface depressions for each HRU	nhru	acre-inches	double	dprst_flag = 1
<i>dprst_vol_open_frac</i>	Fraction of open surface-depression storage of the maximum storage for each HRU	nhru	decimal fraction	double	dprst_flag = 1
<i>hru_frac_dprst</i>	Fraction of HRU that has surface-depression storage	nhru	decimal fraction	real	dprst_flag = 1
Soil zone storage, interflow, gravity drainage, Dunnian surface runoff					
<i>basin_cap_up_max</i>	Basin area-weighted average maximum cascade flow that flows to capillary reservoirs	one	inches	double	cascade_flag = 1 and ncascade > 0
<i>basin_capwaterin</i>	Basin area-weighted average infiltration and any cascading interflow and Dunnian flow added to capillary reservoir storage	one	inches	double	always
<i>basin_cpr_stor_frac</i>	Basin area-weighted average fraction of capillary reservoir storage of the maximum storage	one	decimal fraction	double	always
<i>basin_dncascadeflow</i>	Basin area-weighted average cascading interflow and Dunnian surface runoff	one	inches	double	cascade_flag = 1 and ncascade > 0
<i>basin_dndunnianflow</i>	Basin area-weighted average cascading Dunnian flow	one	inches	double	cascade_flag = 1 and ncascade > 0
<i>basin_dninterflow</i>	Basin area-weighted average cascading interflow	one	inches	double	cascade_flag = 1 and

					ncascade > 0
<i>basin_dunnian</i>	Basin area-weighted average Dunnian surface runoff that flows to the stream network	one	inches	double	always
<i>basin_dunnian_gvr</i>	Basin area-weighted average excess flow to preferential-flow reservoirs from gravity reservoirs	one	inches	double	always
<i>basin_dunnian_pfr</i>	Basin area-weighted average excess infiltration to preferential-flow reservoirs from variable <i>infil</i>	one	inches	double	always
<i>basin_gvr2pfr</i>	Basin area-weighted average excess flow to preferential-flow reservoir storage from gravity reservoirs	one	inches	double	always
<i>basin_gvr_stor_frac</i>	Basin area-weighted average fraction of gravity reservoir storage of the maximum storage	one	decimal fraction	double	always
<i>basin_interflow_max</i>	Basin area-weighted average maximum interflow that flows from gravity reservoirs	one	inches	double	always
<i>basin_lakeinsz</i>	Basin area-weighted average lake inflow from land HRUs	one	inches	double	cascade_flag = 1, ncascade > 0, and nlake > 0
<i>basin_pfr_stor_frac</i>	Basin area-weighted average fraction of preferential-flow reservoir storage of the maximum storage	one	decimal fraction	double	always
<i>basin_pref_flow_infil</i>	Basin area-weighted average infiltration to preferential-flow reservoir storage	one	inches	double	always
<i>basin_pref_stor</i>	Basin area-weighted average storage in preferential-flow reservoirs	one	inches	double	always
<i>basin_prefflow</i>	Basin area-weighted average interflow from preferential-flow reservoirs to the stream network	one	inches	double	always
<i>basin_recharge</i>	Basin area-weighted average recharge to GWRs	one	inches	double	always
<i>basin_slowflow</i>	Basin area-weighted average interflow from gravity reservoirs to the stream network	one	inches	double	always
<i>basin_slstor</i>	Basin area-weighted average storage of gravity reservoirs	one	inches	double	always
<i>basin_sm2gvr</i>	Basin area-weighted average excess flow from capillary reservoirs to gravity reservoir storage	one	inches	double	always
<i>basin_sm2gvr_maxin</i>	Basin area-weighted average maximum excess flow from capillary reservoirs that flows to gravity reservoirs	one	inches	double	always
<i>basin_soil_lower_stor_frac</i>	Basin area-weighted average fraction of soil lower zone storage of the maximum storage	one	decimal fraction	double	always
<i>basin_soil_moist</i>	Basin area-weighted average capillary reservoir storage	one	inches	double	always
<i>basin_soil_moist_tot</i>	Basin area-weighted average total soil-zone water storage	one	inches	double	always
<i>basin_soil_rechr</i>	Basin area-weighted average storage for recharge zone; upper portion of capillary reservoir where both evaporation and transpiration occurs	one	inches	double	always
<i>basin_soil_rechr_stor_frac</i>	Basin area-weighted average fraction of soil recharge zone storage	one	decimal fraction	double	always

	storage of the maximum storage				
<i>basin_soil_to_gw</i>	Basin area-weighted average excess flow to capillary reservoirs that drains to GWRs	one	inches	double	always
<i>basin_ssflow</i>	Basin area-weighted average interflow from gravity and preferential-flow reservoirs to the stream network	one	inches	double	always
<i>basin_ssflow_cfs</i>	Basin area-weighted average interflow from gravity and preferential-flow reservoirs to the stream network	one	cfs	double	always
<i>basin_ssflow_mo</i>	Monthly basin area-weighted average interflow	one	inches	double	always
<i>basin_ssflow_tot</i>	Simulation total basin area-weighted average interflow	one	inches	double	always
<i>basin_ssflow_yr</i>	Yearly basin area-weighted average interflow	one	inches	double	always
<i>basin_ssini</i>	Basin area-weighted average inflow to gravity and preferential-flow reservoir storage	one	inches	double	always
<i>basin_ssstor</i>	Basin area-weighted average gravity and preferential-flow reservoir storage	one	inches	double	always
<i>basin_sz2gw</i>	Basin area-weighted average drainage from gravity reservoirs to GWRs	one	inches	double	always
<i>basin_sz_stor_frac</i>	Basin area-weighted average fraction of soil zone storage storage of the maximum storage	one	decimal fraction	double	always
<i>cap_infil_tot</i>	Infiltration and cascading interflow and Dunnian flow added to capillary reservoir storage for each HRU	nhru	inches	real	always
<i>cap_waterin</i>	Infiltration and any cascading interflow and Dunnian surface runoff added to capillary reservoir storage for each HRU	nhru	inches	real	always
<i>dunnian_flow</i>	Dunnian surface runoff that flows to the stream network for each HRU	nhru	inches	real	always
<i>hru_sz_cascadeflow</i>	Cascading interflow and Dunnian surface runoff from each HRU	nhru	inches	real	cascade_flag = 1 and ncascade > 0
<i>pref_flow</i>	Interflow from the preferential-flow reservoir that flows to the stream network for each HRU	nhru	inches	real	always
<i>pref_flow_in</i>	Infiltration and flow from gravity reservoir storage to the preferential-flow reservoir	nhru	inches	real	always
<i>pref_flow_infil</i>	Infiltration to the preferential-flow reservoir storage for each HRU	nhru	inches	real	always
<i>pref_flow_max</i>	Maximum storage of the preferential-flow reservoir for each HRU	nhru	inches	real	always
<i>pref_flow_stor</i>	Storage in preferential-flow reservoir for each HRU	nhru	inches	real	always
<i>pref_flow_thrsh</i>	Soil storage threshold defining storage between field capacity and maximum soil saturation minus the any' preferential-flow storage	nhru	inches	real	always
<i>recharge</i>	Recharge to the associated GWR as sum of <i>soil_to_gw</i> and' <i>ssr_to_gw</i> for each HRU	nhru	inches	real	always
<i>seginc_ssflow</i>	Area-weighted average interflow for each segment from HRUs contributing flow to the segment	nsegment	cfs	double	nsegment > 0
<i>slow_flow</i>	Interflow from gravity reservoir that flows to the stream network for	nhru	inches	real	always

	each HRU				
<i>slow_stor</i>	Storage of gravity reservoir for each HRU	nhru	inches	real	always
<i>soil_lower</i>	Storage in the lower zone of the capillary reservoir that is only available for transpiration for each HRU	nhru	inches	real	always
<i>soil_lower_ratio</i>	Water content ration in the lower zone of the capillary reservoir for each HRU	nhru	decimal fraction	real	always
<i>soil_moist</i>	Storage of capillary reservoir for each HRU	nhru	inches	real	always
<i>soil_moist_tot</i>	Total soil-zone storage (<i>soil_moist</i> + <i>ssres_stor</i>) for each HRU	nhru	inches	real	always
<i>soil_rechr</i>	Storage for recharge zone (upper portion) of the capillary reservoir that is available for both evaporation and transpiration	nhru	inches	real	always
<i>soil_to_gw</i>	Portion of excess flow to the capillary reservoir that drains to the associated GWR for each HRU	nhru	inches	real	always
<i>soil_to_ssr</i>	Portion of excess flow to the capillary reservoir that flows to the gravity reservoir for each HRU	nhru	inches	real	always
<i>ssr_to_gw</i>	Drainage from the gravity-reservoir to the associated GWR for each HRU	nssr	inches	real	always
<i>ssres_flow</i>	Interflow from gravity and preferential-flow reservoirs to the stream network for each HRU	nssr	inches	real	always
<i>ssres_in</i>	Inflow to the gravity and preferential-flow reservoirs for each HRU	nssr	inches	real	always
<i>ssres_stor</i>	Storage in the gravity and preferential-flow reservoirs for each HRU	nssr	inches	real	always
<i>sub_interflow</i>	Area-weighted average interflow from associated HRUs to each subbasin and from upstream subbasins	nsub	cfs	double	subbasin_flag = 1
<i>subinc_capstor_frac</i>	Area-weighted average fraction of capillary reservoir water content storage for associated HRUs of each subbasin	nsub	decimal fraction	double	subbasin_flag = 1
<i>subinc_interflow</i>	Area-weighted average interflow from associated HRUs to each subbasin	nsub	cfs	double	subbasin_flag = 1
<i>subinc_recharge</i>	Area-weighted average recharge from associated HRUs to each subbasin	nsub	inches	double	subbasin_flag = 1
<i>subinc_szstor_frac</i>	Area-weighted average fraction of soil-zone water content storage for associated HRUs of each subbasin	nsub	decimal fraction	double	subbasin_flag = 1
<i>upslope_dunnianflow</i>	Cascading Dunnian surface runoff that flows to the capillary reservoir of each downslope HRU for each upslope HRU	nhru	inches	double	cascade_flag = 1 and ncascade > 0
<i>upslope_interflow</i>	Cascading interflow runoff that flows to the capillary reservoir of each downslope HRU for each upslope HRU	nhru	inches	double	cascade_flag = 1 and ncascade > 0
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	Groundwater flow				
<i>basin_gwflow</i>	Basin area-weighted average groundwater flow to the stream network	one	inches	double	always
<i>basin_gwflow_cfs</i>	Basin area-weighted average groundwater flow to the stream network	one	cfs	double	always

<i>basin_gwflow_mo</i>	Monthly basin area-weighted average groundwater discharge	one	inches	double	always
<i>basin_gwflow_tot</i>	Total simulation basin area-weighted average groundwater discharge	one	inches	double	always
<i>basin_gwflow_yr</i>	Yearly basin area-weighted average groundwater discharge	one	inches	double	always
<i>basin_gwin</i>	Basin area-weighted average inflow to GWRs	one	inches	double	always
<i>basin_gwsink</i>	Basin area-weighted average GWR outflow to the groundwater sink	one	inches	double	always
<i>basin_gwstor</i>	Basin area-weighted average storage in GWRs	one	inches	double	always
<i>basin_gwstor_minarea_wb</i>	Basin area-weighted average storage added to each GWR when storage is less than gwstor_min	one	inches	double	always
<i>gw_in_soil</i>	Drainage from capillary reservoir excess water for each GWR	ngw	acre-inches	double	always
<i>gw_in_ssr</i>	Drainage from gravity reservoir excess water for each GWR	ngw	acre-inches	double	always
<i>gw_upslope</i>	Groundwater flow received from upslope GWRs for each GWR	ngw	acre-inches	double	cascadegw_flag = 1 and ncascdgw > 0
<i>gwres_flow</i>	Groundwater discharge from each GWR to the stream network	ngw	inches	real	always
<i>gwres_in</i>	Total inflow to each GWR from associated capillary and gravity reservoirs	ngw	acre-inches	double	always
<i>gwres_sink</i>	Outflow from GWRs to the groundwater sink; water is considered underflow or flow to deep aquifers and does not flow to the stream network	ngw	inches	real	always
<i>gwres_stor</i>	Storage in each GWR	ngw	inches	double	always
<i>gwstor_minarea_wb</i>	Storage added to each GWR when storage is less than gwstor_min	ngw	inches	double	always
<i>hru_gw_cascadeflow</i>	Cascading groundwater flow from each GWR	ngw	inches	double	cascadegw_flag = 1 and ncascdgw > 0
<i>seginc_gwflow</i>	Area-weighted average groundwater discharge for each segment from HRUs contributing flow to the segment	nsegment	cfs	double	nsegment > 0
<i>sub_gwflow</i>	Area-weighted average groundwater discharge from associated GWRs to each subbasin and from upstream subbasins	nsub	cfs	double	subbasin_flag = 1
<i>subinc_gwflow</i>	Area-weighted average groundwater discharge from associated GWRs to each subbasin	nsub	cfs	double	subbasin_flag = 1
Streamflow					
<i>basin_cfs</i>	Streamflow leaving the basin through the stream network	one	cfs	double	always
<i>basin_cfs_mo</i>	Monthly total streamflow to stream network	one	cfs	double	always
<i>basin_cfs_tot</i>	Total simulation basin area-weighted average streamflow	one	cfs	double	always
<i>basin_cfs_yr</i>	Yearly total streamflow to stream network	one	cfs	double	always
<i>basin_cms</i>	Streamflow leaving the basin through the stream network	one	cms	double	always
<i>basin_runoff_ratio</i>	Basin area-weighted average discharge/precipitation	one	decimal fraction	double	always
<i>basin_runoff_ratio_mo</i>	Monthly area-weighted average discharge/precipitation	one	decimal fraction	double	always
<i>basin_segment_storage</i>	Basin area-weighted average storage in the stream network	one	inches	double	always
<i>basin_stflow_in</i>	Basin area-weighted average lateral flow entering the stream network	one	inches	double	always
<i>basin_stflow_mo</i>	Monthly basin area-weighted average simulated streamflow	one	inches	double	always

<i>basin_stflow_out</i>	Basin area-weighted average streamflow leaving through the stream network	one	inches	double	always
<i>basin_stflow_tot</i>	Total simulation basin area-weighted average simulated streamflow	one	inches	double	always
<i>basin_stflow_yr</i>	Yearly basin area-weighted average simulated streamflow	one	inches	double	always
<i>flow_out</i>	Total flow out of model domain	one	cfs	double	always
<i>hru_outflow</i>	Total flow leaving each HRU	nhru	cfs	double	always
<i>hru_streamflow_out</i>	Total flow to stream network from each HRU	nhru	cfs	double	always
<i>obs_runoff_mo</i>	Monthly measured streamflow at basin outlet	one	cfs	double	always
<i>obs_runoff_tot</i>	Total simulation measured streamflow at basin outlet	one	cfs	double	always
<i>obs_runoff_yr</i>	Yearly measured streamflow at basin outlet	one	cfs	double	always
<i>obsq_inches</i>	Measured streamflow at specified outlet station	one	inches	double	always
<i>obsq_inches_mo</i>	Monthly measured streamflow at specified outlet station	one	inches	double	always
<i>obsq_inches_tot</i>	Total simulation basin area-weighted average measured streamflow at specified outlet station	one	inches	double	always
<i>obsq_inches_yr</i>	Yearly measured streamflow at specified outlet station	one	inches	double	always
<i>runoff</i>	Streamflow at each measurement station	nobs	runoff_units	real	nobs > 0
<i>seg_gwflow</i>	Area-weighted average groundwater discharge for each segment from HRUs contributing flow to the segment and upstream HRUs	nsegment	inches	double	nsegment > 0
<i>seg_inflow</i>	Total flow entering a segment	nsegment	cfs	double	nsegment > 0
<i>seg_lateral_inflow</i>	Lateral inflow entering a segment	nsegment	cfs	double	nsegment > 0
<i>seg_outflow</i>	Streamflow leaving a segment	nsegment	cfs	double	nsegment > 0
<i>seg_sroff</i>	Area-weighted average surface runoff for each segment from HRUs contributing flow to the segment and upstream HRUs	nsegment	inches	double	nsegment > 0
<i>seg_ssflow</i>	Area-weighted average interflow for each segment from HRUs contributing flow to the segment and upstream HRUs	nsegment	inches	double	nsegment > 0
<i>seg_upstream_inflow</i>	Sum of inflow from upstream segments	nsegment	cfs	double	nsegment > 0
<i>segment_delta_flow</i>	Cummulative flow minus flow out for each stream segment	nsegment	cfs	double	strmflow_module = muskingum
<i>streamflow_cfs</i>	Streamflow at each measurement station	nobs	cfs	double	nobs > 0
<i>streamflow_cms</i>	Streamflow at each measurement station	nobs	cms	double	nobs > 0
<i>strm_seg_in³</i>	Flow in stream segments as a result of cascading flow in each stream segment	nsegment	cfs	double	cascade_flag = 1 and ncascade > 0
<i>sub_cfs</i>	Total streamflow leaving each subbasin	nsub	cfs	double	subbasin_flag = 1
<i>sub_cms</i>	Total streamflow from each subbasin	nsub	cms	double	subbasin_flag = 1
<i>sub_inq</i>	Sum of streamflow from upstream subbasins to each subbasin	nsub	cfs	double	subbasin_flag = 1
Lake dynamics					
<i>basin_lake_stor</i>	Basin volume-weighted average storage for all lakes using broad-crested weir or gate opening routing	one	inches	double	always

<i>lakein_sz</i>	Cascading interflow and Dunnian surface runoff to lake HRUs for each upslope HRU	nhru	inches	double	cascade_flag = 1, ncascade > 0, and nlake > 0
Water balance					
<i>basin_capillary_wb</i>	Basin area-weighted average capillary reservoir storage	one	inches	double	print_debug = 1
<i>basin_dprst_wb</i>	Basin area-weighted average surface-depression storage	one	inches	double	print_debug = 1
<i>basin_gravity_wb</i>	Basin area-weighted average gravity reservoir storage	one	inches	double	print_debug = 1
<i>basin_soilzone_wb</i>	Basin area-weighted average storage in soilzone reservoirs	one	inches	double	print_debug = 1
<i>basin_storage</i>	Basin area-weighted average storage in all water-storage reservoirs	one	inches	double	always
<i>basin_storvol</i>	Basin area-weighted average storage volume in all water-storage reservoirs	one	acre-inches	double	always
<i>hru_lateral_flow</i>	Lateral flow to stream network from each HRU	nhru	cfs	double	always
<i>hru_storage</i>	Storage for each HRU	nhru	inches	double	always
<i>last_basin_stor</i>	Basin area-weighted average storage in all water storage reservoirs from previous time step	one	inches	double	print_debug = 1
<i>subinc_deltastor</i>	Change in storage for each subbasin	nsb	inches	double	subbasin_flag = 1
<i>subinc_stor</i>	Area-weighted average total water content in storage reservoirs associated HRUs of each subbasin	nsb	inches	double	subbasin_flag = 1
<i>subinc_wb</i>	Water balance for each subbasin	nsb	inches	double	subbasin_flag = 1
<i>watbal_sum</i>	Water balance aggregate	one	inches	double	always
GSFLOW					
<i>ActualET_Q</i>	Volumetric flow rate of actual evaporation from HRUs	one	L3/T	double	model_mode=GSFLOW
<i>Ave_SoilDrainage2Unsat_Q</i>	Running average gravity drainage to the unsaturated and saturated zones	one	L3	double	model_mode=GSFLOW
<i>BoundaryStreamFlow_Q</i>	Volumetric specified streamflow into the model domain to SFR	one	L3/T	double	model_mode=GSFLOW
<i>CanopyEvap_Q</i>	Volumetric flow rate of evaporation of intercepted precipitation	one	L3/T	double	model_mode=GSFLOW
<i>Canopy_S</i>	Volume of intercepted precipitation in plant-canopy reservoirs	one	L3	double	model_mode=GSFLOW
<i>CapDrainage2Sat_Q</i>	Volumetric flow rate of direct gravity drainage from excess capillary water to the unsaturated zone	one	L3/T	double	model_mode=GSFLOW
<i>CapET_Q</i>	Volumetric flow rate of evapotranspiration from pervious areas	one	L3/T	double	model_mode=GSFLOW
<i>Cap_S</i>	Volume of water in capillary reservoirs of the soil zone	one	L3	double	model_mode=GSFLOW
<i>DprstEvap_Q</i>	Volumetric flow rate of evaporation from surface depressions	one	L3/T	double	model_mode=GSFLOW
<i>Dprst_S</i>	Volume of water stored in surface-depression storage	one	L3	double	model_mode=GSFLOW
<i>DunnInterflow2Cap_Q</i>	Volumetric flow rate of cascading Dunnian runoff and interflow to HRUs	one	L3/T	double	model_mode=GSFLOW
<i>DunnInterflow2Lake_Q</i>	Volumetric flow rate of interflow and Dunnian surface runoff to lakes	one	L3/T	double	model_mode=GSFLOW
<i>DunnSroff2Stream_Q</i>	Volumetric flow rate of Dunnian runoff to streams	one	L3/T	double	model_mode=GSFLOW

<i>Grav_S</i>	Volume of water in gravity reservoirs of the soil zone	one	L3	double	model_mode=GSFLOW
<i>HortSroff2Lake_Q</i>	Volumetric flow rate of Hortonian surface runoff to lakes	one	L3/T	double	model_mode=GSFLOW
<i>HortSroff2Stream_Q</i>	Volumetric flow rate of Hortonian runoff to streams	one	L3/T	double	model_mode=GSFLOW
<i>ImpervEvap_Q</i>	Volumetric flow rate of evaporation from impervious areas	one	L3/T	double	model_mode=GSFLOW
<i>Imperv_S</i>	Volume of water in impervious reservoirs	one	L3	double	model_mode=GSFLOW
<i>Infil2CapTotal_Q</i>	Volumetric flow rate of soil infiltration into capillary reservoirs including precipitation, snowmelt, and cascading Hortonian and Dunnian runoff and interflow minus infiltration to preferential-flow reservoirs	one	L3/T	double	model_mode=GSFLOW
<i>Infil2Pref_Q</i>	Volumetric flow rate of soil infiltration into preferential-flow reservoirs including precipitation, snowmelt, and cascading surface runoff	one	L3/T	double	model_mode=GSFLOW
<i>Infil2Soil_Q</i>	Volumetric flow rate of soil infiltration (including precipitation, snowmelt, and cascading Hortonian flow)	one	L3/T	double	model_mode=GSFLOW
<i>Interflow2Stream_Q</i>	Volumetric flow rate of slow plus fast interflow to streams	one	L3/T	double	model_mode=GSFLOW
<i>KKITER</i>	Current iteration in GSFLOW simulation	one	none	integer	model_mode=GSFLOW
<i>Lake2Sat_Q</i>	Volumetric flow rate of lake leakage to the unsaturated and saturated zones	one	L3/T	double	model_mode=GSFLOW
<i>Lake2Unsat_Q</i>	Volumetric flow rate between lakes and the unsaturated zone (value is equal to <i>Strm2UZGW</i> minus <i>SatDisch2Stream_Q</i> , where a negative value indicates a net loss from streams)	one	L3/T	double	model_mode=GSFLOW
<i>LakeEvap_Q</i>	Volumetric flow rate of evaporation from lakes	one	L3/T	double	model_mode=GSFLOW
<i>LakeExchng2Sat_Q</i>	Volumetric flow rate of exchange between lakes and the saturated zone (value is equal to <i>Strm2UZGW</i> minus <i>SatDisch2Stream_Q</i> , where a negative value indicates a net loss from streams)	one	L3/T	double	model_mode=GSFLOW
<i>LakePrecip_Q</i>	Volumetric flow rate of precipitation on lakes	one	L3/T	double	model_mode=GSFLOW
<i>Lake_S</i>	Volume of water in lakes	one	L3	double	model_mode=GSFLOW
<i>Lake_dS</i>	Change in lake storage	one	L3	double	model_mode=GSFLOW
<i>NetBoundaryFlow2Sat_Q</i>	Volumetric flow rate to the saturated zone along the external boundary (negative value is flow out of model domain)	one	L3/T	double	model_mode=GSFLOW
<i>NetWellFlow_Q</i>	Net volumetric flow rate of groundwater injection or removal from wells	one	L3/T	double	model_mode=GSFLOW
<i>PotGravDrn2Unsat_Q</i>	Potential volumetric flow rate of gravity drainage from the soil zone to the unsaturated zone (before conditions of the unsaturated and saturated zones are applied)	one	L3/T	double	model_mode=GSFLOW
<i>Precip_Q</i>	Volumetric flow rate of precipitation	one	L3/T	double	model_mode=GSFLOW
<i>Pref_S</i>	Volume of water stored in preferential-flow reservoirs of the soil zone	one	L3	double	model_mode=GSFLOW
<i>RechargeUnsat2Sat_Q</i>	Volumetric flow rate of recharge from the unsaturated zone to the saturated zone	one	L3/T	double	model_mode=GSFLOW

<i>Sat2Grav_Q</i>	Volumetric flow rate of groundwater discharge from the saturated zone to the soil zone	one	L3/T	double	model_mode=GSFLOW
<i>SatDisch2Lake_Q</i>	Volumetric flow rate of groundwater discharge to lakes	one	L3/T	double	model_mode=GSFLOW
<i>SatDisch2Stream_Q</i>	Volumetric flow rate of groundwater discharge to streams	one	L3/T	double	model_mode=GSFLOW
<i>SatET_Q</i>	Volumetric flow rate of evapotranspiration from the saturated zone	one	L3/T	double	model_mode=GSFLOW
<i>Sat_S</i>	Volume of water in the saturated zone	one	L3	double	model_mode=GSFLOW
<i>Sat_dS</i>	Change in saturated-zone storage	one	L3	double	model_mode=GSFLOW
<i>SnowEvap_Q</i>	Volumetric flow rate of snowpack sublimation	one	L3/T	double	model_mode=GSFLOW
<i>SnowMelt_Q</i>	Volumetric flow rate of snowmelt	one	L3/T	double	model_mode=GSFLOW
<i>SnowPweqv_S</i>	Volume of water in snowpack storag	one	L3	double	model_mode=GSFLOW
<i>SoilDrainage2Unsat_Q</i>	Volumetric flow rate of gravity drainage to the unsaturated and saturated zones	one	L3/T	double	model_mode=GSFLOW
<i>Sroff2Stream_Q</i>	Volumetric flow rate of surface runoff to streams	one	L3/T	double	model_mode=GSFLOW
<i>Stream2Sat_Q</i>	Volumetric flow rate of stream leakage to the unsaturated and saturated zones	one	L3/T	double	model_mode=GSFLOW
<i>Stream2Unsat_Q</i>	Volumetric flow rate between streams and the unsaturated zone (value is equal to <i>Strm2UZGW</i> minus <i>SatDisch2Stream_Q</i> , where a negative value indicates a net loss from streams)	one	L3/T	double	model_mode=GSFLOW
<i>StreamExchng2Sat_Q</i>	Volumetric flow rate of exchange between streams and the saturated zone (value is equal to <i>Strm2UZGW</i> minus <i>SatDisch2Stream_Q</i> , where a negative value indicates a net loss from streams)	one	L3/T	double	model_mode=GSFLOW
<i>StreamOut_Q</i>	Volumetric flow rate of streamflow leaving modeled region	one	L3/T	double	model_mode=GSFLOW
<i>Stream_S</i>	Volume of water in streams (non-zero only when transient routing option is used in SFR2)	one	L3	double	model_mode=GSFLOW
<i>SwaleEvap_Q</i>	Volumetric flow rate of evaporation from swale HRUs	one	L3/T	double	model_mode=GSFLOW
<i>UnsatDrainageExcess_Q</i>	Volumetric flow rate of gravity drainage from the soil zone not accepted due to conditions in the unsaturated and saturated zones	one	L3/T	double	model_mode=GSFLOW
<i>UnsatET_Q</i>	Volumetric flow rate of evapotranspiration from the unsaturated zone	one	L3/T	double	model_mode=GSFLOW
<i>UnsatStream_S</i>	Volume of water in the unsaturated zone under streams	one	L3	double	model_mode=GSFLOW
<i>UnsatStream_dS</i>	Change in unsaturated-zone storage under streams	one	L3	double	model_mode=GSFLOW
<i>Unsat_S</i>	Volume of water in the unsaturated zone	one	L3	double	model_mode=GSFLOW
<i>Unsat_dS</i>	Change in unsaturated-zone storage	one	L3	double	model_mode=GSFLOW
<i>actet_gw</i>	Actual ET from each GW cell	nhru	inches	real	model_mode=GSFLOW
<i>actet_tot_gwsz</i>	Total actual ET from each GW cell and PRMS soil zone	nhru	inches	real	model_mode=GSFLOW
<i>basin_gvr2sm</i>	Basin area-weighted average gravity flow to capillary reservoirs	one	inches	double	model_mode=GSFLOW
<i>basin_gw2sm</i>	Basin average water exfiltrated from unsaturated and saturated zones and added to soil zone	one	inches	double	model_mode=GSFLOW
<i>basin_reach_latflow</i>	Lateral flow into all reaches in basin	one	cfs	double	model_mode=GSFLOW

<i>basin_szreject</i>	Basin average recharge from SZ and rejected by UZF	one	inches	double	model_mode=GSFLOW
<i>basingvr2sm</i>	Volumetric flow rate of flow from gravity reservoirs to capillary reservoirs	one	L3/T	double	model_mode=GSFLOW
<i>basinrain</i>	Volumetric flow rate of rain	one	L3/T	double	model_mode=GSFLOW
<i>basinseepout</i>	Volumetric flow rate of groundwater discharge from the saturated zone to the soil zone	one	L3/T	double	model_mode=GSFLOW
<i>basinsm2gvr</i>	Volumetric flow rate of flow from capillary reservoirs to gravity reservoirs	one	L3/T	double	model_mode=GSFLOW
<i>basinsnow</i>	Volumetric flow rate of snow	one	L3/T	double	model_mode=GSFLOW
<i>basinsoilstor</i>	Volume of soil moisture storage	one	L3	double	model_mode=GSFLOW
<i>cell_drain_rate</i>	Recharge rate for each cell	ngwcell	L/T	real	model_mode=GSFLOW
<i>cum_pweqv</i>	Cumulative change in snowpack storage	one	L3	double	model_mode=GSFLOW
<i>cum_satstor</i>	Cumulative change in saturated storage	one	L3	double	model_mode=GSFLOW
<i>cum_soilstor</i>	Cumulative change in soil storage	one	L3	double	model_mode=GSFLOW
<i>cum_uzstor</i>	Cumulative change in unsaturated storage	one	L3	double	model_mode=GSFLOW
<i>grav_gwin</i>	Groundwater discharge to gravity-flow reservoirs for each HRU	nhru	inches	real	model_mode=GSFLOW
<i>gravity_stor_res</i>	Storage in each gravity-flow reservoir	nhrucell	inches	real	model_mode=GSFLOW
<i>gvr2sm</i>	Gravity flow to soil moist replenishment for each HRU	nhru	inches	real	model_mode=GSFLOW
<i>gw2sm</i>	HRU average water exfiltrated from groundwater model and added back to soil zone	nhru	inches	real	model_mode=GSFLOW
<i>gw2sm_grav</i>	Groundwater discharge to gravity-flow reservoirs	nhrucell	inches	real	model_mode=GSFLOW
<i>gw_rejected</i>	HRU average recharge rejected by UZF	nhru	inches	real	model_mode=GSFLOW
<i>gw_rejected_grav</i>	Recharge rejected by UZF for each gravity-flow reservoir	nhrucell	inches	real	model_mode=GSFLOW
<i>net_sz2gw</i>	Net volumetric flow rate of gravity drainage from the soil zone to the unsaturated and saturated zones	one	L3/T	double	model_mode=GSFLOW
<i>obs_strmflow</i>	Volumetric flow rate of streamflow measured at a gaging station	one	L3/T	double	model_mode=GSFLOW
<i>rate_pweqv</i>	Change in snow pack storage	one	L3	double	model_mode=GSFLOW
<i>rate_satstor</i>	Change in saturated storage	one	L3	double	model_mode=GSFLOW
<i>rate_soilstor</i>	Change in soil storage	one	L3	double	model_mode=GSFLOW
<i>rate_uzstor</i>	Change in unsaturated storage	one	L3	double	model_mode=GSFLOW
<i>reach_cfs</i>	Stream flow leaving each stream reach	nreach	cfs	real	model_mode=GSFLOW
<i>reach_wse</i>	Water surface elevation in each stream reach	nreach	L	real	model_mode=GSFLOW
<i>sm2gw_grav</i>	Drainage from each gravity reservoir to each MODFLOW cell	nhrucell	inches	real	model_mode=GSFLOW
<i>stream_inflow</i>	Specified volumetric stream inflow rate into model	one	L3/T	double	model_mode=GSFLOW
<i>streamflow_sfr</i>	Streamflow as computed by SFR for each segment	nsegment	cfs	real	model_mode=GSFLOW
<i>total_pump</i>	Total pumpage from all cells	one	L3	double	model_mode=GSFLOW
<i>total_pump_cfs</i>	Total pumpage from all cells	one	cfs	double	model_mode=GSFLOW
<i>uzf_et</i>	Volumetric flow rate of evapotranspiration from the unsaturated and saturated zones	one	L3/T	double	model_mode=GSFLOW

¹Dimension variables defined in table 1-1.

²Set by precipitation distribution module and can be modified by the interception module if all precipitation captured in canopy.

³Initially set by surface runoff module and can be modified by the soilzone module if Dunnian surface runoff occurs.

⁴Reflects availability of variables based on module selections. See variable description for the reason(s) a variable is conditional or always available.

⁵Values are set to the last valid computed value; value is < -99.0 or > 150.

