



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 5 (PRMS-V)**.

[green highlight indicates new for PRMS-V]

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.
dynamic_param_read	Read and makes available dynamic parameters by HRU from pre-processed files.
water_use_read	Read and makes available water-use data (diversions and gains) from pre-processed files.
Temperature distribution process	
temp_1sta	Distributes maximum and minimum temperatures to each HRU by using temperature data measured at one station and specified monthly lapse rates.
temp_laps	Distributes maximum and minimum temperatures to each HRU by computing a daily lapse rate with temperature data measured at a base station and a lapse station with differing altitudes.
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.
temp_sta	Distributes maximum and minimum temperatures to each HRU by using temperature data measured at one station, similar to temp_1sta except there is no lapse rate.
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 method.
transp_tindex	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 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	
sr runoff_smidx	Computes surface runoff and infiltration for each HRU by using a nonlinear variable-source-area method allowing for cascading flow.
sr runoff_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	
muskingum	Computes flow in the stream network using the Muskingum routing method.
muskingum_lake	Computes flow in the stream network using the Muskingum routing method and flow and storage in on-channel lake using several methods.
routing	Computes common segment routing flows for modules <code>strmflow_in_out</code> and <code>Muskingum</code> .
stream_temp	Computes daily mean water temperature in the stream network based on the U.S. Fish and Wildlife Service Stream Network Temperature model, a mechanistic, one-dimensional heat transport model.
strmflow	Computes daily streamflow as the sum of surface runoff, shallow-subsurface flow (interflow),

strmflow_in_out	detention reservoir flow, and groundwater flow.
strmflow_lake	Routes water between segments in the stream network by setting the outflow to the inflow. Computes basin on channel reservoir storage and outflows.
Summary process	
basin_sum	Computes daily, monthly, yearly, and total flow summaries of volumes and flows for all HRUs.
basin_summary	Write user-selected results dimensioned by the value of dimension one to separate CSV Files at daily, monthly, mean monthly, mean yearly, and yearly total time steps when control parameter basinOutON_OFF is specified equal to 1.
convert_params	Writes values for new PRMS-V parameters to a file based on a PRMS-IV Parameter File when control parameter model_mode is specified equal to CONVERT. Writes values for old PRMS-IV parameters to a file based on a PRMS-V Parameter File when control parameter model_mode is specified equal to CONVERT4.
frost_date	Writes a parameter file of the last spring frost and first fall frost for each HRU based on the simulation time period and distributed temperature as required by the <code>transp_frost</code> module; land, subsurface, and stream processes are not computed.
map_results	Writes HRU summaries to a user specified target map at weekly, monthly, yearly, and total time steps.
nhru_summary	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 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 or 2.
nsub_summary	Write 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 or 2.
prms_summary	Writes selected basin area-weighted results to a Comma-Separated Values (CSV) File when control parameter csvON_OFF is specified equal to 1.
subbasin	Computes streamflow at internal basin nodes and variables by subbasin.
write_climate_hru	Writes climate-by-HRU Files of user-selected climate variables on the basis of distributed climate; land, subsurface, and stream processes are not computed.

Table 1-1. Dimensions used in the Precipitation-Runoff Modeling System, **version 5 (PRMS-V).**

[HRU, hydrologic response unit; GWR, groundwater reservoir; >, greater than; **POI, points-of-interest**; control parameters **temp_module**, **precip_module**, **solrad_module**, **et_module**, **strmflow_module**, **subbasin_flag**, **cascade_flag**, **cascadegw_flag**, and **mapOutON_OFF** defined in table 1-2; parameter **hru_solsta** defined in table 1-3; **green** highlight indicates new for PRMS-V]

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
nhru	Number of hydrologic response units	1	required
nhruccell	Number of unique intersections between HRUs and spatial units of a target map for mapped results	0	mapOutON_OFF = 1
nlake	Number of lakes	0	required when any HRU has hru_type specified equal to 2
nsegment	Number of stream-channel segments	0	strmflow_module = muskingum lake , muskingum, or strmflow_in_out or cascade_flag = 1 or 2 or cascadegw_flag = 1 or 2
nssr ²	Number of subsurface reservoirs	1	required
nsub	Number of internal subbasins	0	subbasin_flag = 1
Time-series input data dimensions ¹			
nconsumed	Number of consumptive water-use destinations	0	optional
nevap	Number of pan-evaporation data sets	0	et_module = potet_pan
nexternal	Number of external water-use sources or destinations	0	optional
nhumid	Number of relative humidity measurement stations	0	optional
nlakeelev	Maximum number of lake elevations for any rating table data set	0	strmflow_module = muskingum lake
nobs	Number of streamflow-measurement stations	0	replacement flow when strmflow_module = muskingum lake , muskingum, or strmflow_in_out
npoigages	Number of points-of-interest streamflow gages	0	optional
nrain	Number of precipitation-measurement stations	0	precip_module = precip_1sta , precip_laps , precip_dist2 , ide_dist , or xyz_dist
nratetbl	Number of rating-table data sets for lake elevations	0	strmflow_module = muskingum lake
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_sta , temp_laps , temp_dist2 , ide_dist , or xyz_dist
nwind	Number of wind-speed measurement stations	0	Optional

Dimension ³	Description	Default	Required/Condition
Computation dimensions			
ncascade	Number of HRU links for cascading flow	0	cascade_flag = 1 or 2
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
Lake computation dimensions			
mxnsos	Maximum number of storage/outflow table values for storage-detention reservoirs and lakes connected to the stream network using Puls routing	0	strmflow_module = muskingum_lake
ngate	Maximum number of reservoir gate-opening values (columns) for lake rating table 1	0	strmflow_module = muskingum_lake and nratetbl > 0
ngate2	Maximum number of reservoir gate-opening values (columns) for lake rating table 2	0	strmflow_module = muskingum_lake and nratetbl > 1
ngate3	Maximum number of reservoir gate-opening values (columns) for lake rating table 3	0	strmflow_module = muskingum_lake and nratetbl > 2
ngate4	Maximum number of reservoir gate-opening values (columns) for lake rating table 4	0	strmflow_module = muskingum_lake and nratetbl > 3
nstage	Maximum number of lake elevations values (rows) for lake rating table 1	0	strmflow_module = muskingum_lake and nratetbl > 0
nstage2	Maximum number of lake elevations values (rows) for lake rating table 2	0	strmflow_module = muskingum_lake and nratetbl > 1
nstage3	Maximum number of lake elevations values (rows) for lake rating table 3	0	strmflow_module = muskingum_lake and nratetbl > 2
nstage4	Maximum number of lake elevations values (rows) for lake rating table 4	0	strmflow_module = muskingum_lake and nratetbl > 3
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; **green** highlight indicates new for PRMS-V]

Parameter name	Description	Option	Number of Values	Data type	Default value
Simulation execution and required input and output files					
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	prms.data
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
model_mode	Flag to indicate the simulation mode (PRMS or GSFLOW=version IV parameters; PRMS5 or GSFLOW5=version V parameters; 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> -Langleys); potential ET (variable <i>potet</i> -inches); and/or transpiration flag (variable <i>transp_on</i> -none); POTET=simulate to potential ET; TRANSPIRE=simulate to transpiration period; 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	prms.out
param_file ²	Pathname(s) for Parameter File(s)	parameter input	number of Parameter Files	4	prms.params
prms_warmup	Number of years to simulate before writing mapped results, Basin, nhru , nsub , or nsegment Summary Output Files	map_resultsON_OFF = 1, basinOutON_OFF = 1, nsubOutON_OFF = 1, nsegmentOutON_OFF = 1 or 2, or nhruOutON_OFF = 1 or 2	1	1	1
start_time	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; 2=simple cascades defined by parameter hru_segment)	cascade flow with ncascade > 0	1	1	1

Parameter name	Description	Option	Number of Values	Data type	Default value
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, strmflow_in_out, or muskingum_lake)	module selection	1	4	strmflow
stream_temp_flag	Flag to indicate if stream temperature simulation is computed (0=no; 1=yes)	stream temperature	1	1	0
strmtemp_humidity_flag	Flag to indicate if humidity is input in CBH file for stream temperature simulation is computed (0=no; 1=yes)	stream temperature	1	1	0
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_sta , 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; 1=yes)	input options	1	1	0
humidity_day²	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	1	4	humidity.day

Parameter name	Description	Option	Number of Values	Data type	Default value
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> -Langleys	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
Dynamic Parameter Input					
covden_sum_dynamic	Pathname of the time series of pre-processed values for summer plant-cover density used to set values of covden_sum for each HRU	dyn_covden_flag = 1 or 3	1	4	dyncovsum
covden_win_dynamic	Pathname of the time series of pre-processed values for winter plant-cover density used to set values of covden_win for each HRU	dyn_covden_flag = 2 or 3	1	4	dyncovwin
covtype_dynamic	Pathname of the time series of pre-processed values used to set values of cov_type for each HRU	dyn_covtype_flag = 1	1	4	dyncovtype
dprst_depth_dynamic	Pathname of the time series of pre-processed values used to set values of dprst_depth_avg	dyn_dprst_flag = 2 or 3	1	4	dyndprst_depth
dprst_frac_dynamic	Pathname of the time series of pre-processed values used to set values of dprst_frac	dyn_dprst_flag = 1 or 3	1	4	dyndprst_frac
dyn_covden_flag	Flag to indicate if a time series of plant-canopy density values are input in a Dynamic Parameter File(s) (0=no; 1=file covden_sum_dynamic ; 2=file covden_win_dynamic ; 3=both)	dynamic canopy cover density	1	1	0
dyn_covtype_flag	Flag to indicate if a time series of plant-canopy type values are input in Dynamic Parameter File covtype_dynamic (0=no; 1=yes)	dynamic canopy cover type	1	1	0
dyn_dprst_flag	Flag to indicate if a time series of surface-depression values are input in a Dynamic Parameter File(s) (0=no; 1=file)	dynamic surface depression	1	1	0

Parameter name	Description	Option	Number of Values	Data type	Default value
dyn_fallfrost_flag	dprst_frac_dynamic ; 2=file dprst_depth_dynamic ; 3=both) Flag to indicate if a time series of transpiration start Julian day values are input in a Dynamic Parameter File(s) (0=no; 1=file fallfrost_dynamic)	dynamic transpiration and transp_module = transp_frost	1	1	0
dyn_imperv_flag	Flag to indicate if a time series of impervious values are input in a Dynamic Parameter File(s) (0=no; 1=file imperv_frac_dynamic ; 2=file imperv_stor_dynamic ; 3=both)	dynamic impervious	1	1	0
dyn_intcp_flag	Flag to indicate if a time series of plant canopy interception values are input in a Dynamic Parameter File(s) (0=no; 1=file wrain_intcp_dynamic ; 2=file srain_intcp_dynamic ; 4=file snow_intcp_dynamic ; additive combinations)	dynamic interception	1	1	0
dyn_potet_flag	Flag to indicate if a time series of potential ET coefficient values are input in Dynamic Parameter File potet_coef_dynamic to update coefficients for the specified month for the selected potential ET module specified by control parameter et_module (0=no; 1=parameter jh_coef , pt_alpha , hs_krs , hamon_coef , epan_coef , potet_cbh_adj , and pm_n_coef used in potet_jh , potet_pt , potet_hs , potet_hamon , potet_pan , climate_hru , potet_pm , and potet_pm_sta modules, respectively; 2=parameter jh_coef_hru , pm_d_coef used in potet_jh , potet_pm , and potet_pm_sta modules, respectively)	dynamic potential ET	1	1	0
dyn_radtrncf_flag	Flag to indicate if a time series of solar radiation values are input in Dynamic Parameter File radtrncf_dynamic (0=no; 1=yes)	dynamic solar radiation transmission	1	1	0
dyn_soil_flag	Flag to indicate if a time series of soil-water capacity values are input in a Dynamic Parameter File(s) (0=no; 1=file soilmoist_dynamic only, 2=file soilrechr_dynamic only; 3=both)	dynamic soil moisture	1	1	0
dyn_springfrost_flag	Flag to indicate if a time series of transpiration start Julian day values are input in a Dynamic Parameter File(s) (0=no; 1=file springfrost_dynamic)	dynamic transpiration and transp_module = transp_frost	1	1	0
dyn_sro2dprst_perv_flag	Flag to indicate if a time series of fraction of surface runoff from the pervious portion of an HRU are input in Dynamic Parameter File sro2dprst_perv_dyn (0=no; 1=yes)	dynamic surface depression	1	1	0
dyn_sro2dprst_imperv_flag	Flag to indicate if a time series of fraction of surface runoff from the impervious portion of an HRU are input in Dynamic Parameter File sro2dprst_imperv_dynamic (0=no; 1=yes)	dynamic surface depression	1	1	0
dyn_transp_flag	Flag to indicate if a time series of transpiration month values are input in a Dynamic Parameter File(s) (0=no; 1=file transpbeg_dynamic ; 2=file transpend_dynamic only, 3=both)	dynamic transpiration and transp_module = transp_tindex	1	1	0

Parameter name	Description	Option	Number of Values	Data type	Default value
fallfrost_dynamic	Pathname of the time series of pre-processed values for dynamic parameter fall_frost	dyn_fallfrost_flag = 1 and transp_module = transp_frost	1	4	dynfallfrost
imperv_frac_dynamic	Pathname of the time series of pre-processed values for dynamic parameter hru_percent_imperv	dyn_imperv_flag = 1 or 3	1	4	dynimperv
imperv_stor_dynamic	Pathname of the time series of pre-processed values for dynamic parameter imperv_stor_max	dyn_imperv_flag = 2 or 3	1	4	dynimperv
potet_coef_dynamic	Pathname of the time series of pre-processed potential evapotranspiration coefficient values where the parameter is dependent on the value of et_module	dyn_potet_flag = 1 or 2	1	4	dynpotetcoef
radtrncf_dynamic	Pathname of the time series of pre-processed values for dynamic parameter rad_trncf	dyn_radtrncf_flag = 1	1	4	dynradtrncf
snow_intcp_dynamic	Pathname of the time series of pre-processed values for dynamic parameter snow_intcp	dyn_intcp_flag = 4, 5, 6, or 7	1	4	dynsnowintcp
soilmoist_dynamic	Pathname of the time series of pre-processed values for dynamic parameter soil_moist_max	dyn_soil_flag = 1 or 3	1	4	dynsoilmoist
soilrechr_dynamic	Pathname of the time series of pre-processed values for dynamic parameter soil_rechr_max_frac	dyn_soil_flag = 2 or 3	1	4	dynsoilrechr
springfrost_dynamic	Pathname of the time series of pre-processed values for dynamic parameter spring_frost	dyn_springfrost_flag = 1 and transp_module = transp_frost	1	4	dynspringfrost
srain_intcp_dynamic	Pathname of the time series of pre-processed values for dynamic parameter srain_intcp	dyn_intcp_flag = 2, 3, 6, or 7	1	4	dynsrainintcp
sro2dprst_perv_dynamic	Pathname of the time series of pre-processed values for dynamic parameter sro_to_dprst_perv	dyn_sro2dprst_perv_flag = 1	1	4	dynsrotodprst_perv
sro2dprst_imperv_dynamic	Pathname of the time series of pre-processed values for dynamic parameter sro_to_dprst_imperv	dyn_sro2dprst_imperv_flag = 1	1	4	dynsrotodprst_imperv
transpbeg_dynamic	Pathname of the time series of pre-processed values for dynamic parameter transp_beg	dyn_transp_flag = 1 or 3 and transp_module = transp_tindex	1	4	dyntranspbeg
transpend_dynamic	Pathname of the time series of pre-processed values for dynamic parameter transp_end	dyn_transp_flag = 2 or 3 and transp_module = transp_tindex	1	4	dyntranspend
wrain_intcp_dynamic	Pathname of the time series of pre-processed values for dynamic parameter wrain_intcp	dyn_intcp_flag = 1, 3, 5, or 7	1	4	dynwrainintcp
Water Use Input					
dprst_transfer_file	Pathname of the time series of pre-processed flow rates for transfers	dprst_transferON_OFF =	1	4	dprst.transfer

Parameter name	Description	Option	Number of Values	Data type	Default value
dprst_transferON_OFF	from surface-depression storage Flag to indicate to use time series of surface-depression transfer flow rates from the dprst_transfer_file (0=no; 1=yes)	1 and dprst_flag = 1 surface depression transfer and dprst_flag = 1	1	1	0
external_transfer_file	Pathname of the time series of pre-processed flow rates for transfers from external sources	external_transferON_OFF = 1	1	4	ext.transfer
external_transferON_OFF	Flag to indicate to use external transfer flow rates from the external_transfer_file (0=no; 1=yes)	external transfer	1	1	0
gwr_transfer_file	Pathname of the time series of pre-processed flow rates for transfers from groundwater reservoir storage	gwr_transferON_OFF = 1	1	4	gwr.transfer
gwr_transferON_OFF	Flag to indicate to use groundwater transfer flow rates from the gwr_transfer_file (0=no; 1=yes)	groundwater transfer	1	1	0
lake_transfer_file	Pathname of the time series of pre-processed flow rates for transfers from lake HRUs	lake_transferON_OFF = 1	1	4	lake.transfer
lake_transferON_OFF	Flag to indicate to use lake HRU transfer flow rates from the lake_transfer_file (0=no; 1=yes)	lake water transfer	1	1	0
segment_transfer_file	Pathname of the time series of pre-processed flow rates for transfers from stream segments	segment_transferON_OFF = 1	1	4	seg.transfer
segment_transferON_OFF	Flag to indicate to use stream segment transfer flow rates from the segment_transfer_file (0=no; 1=yes)	stream water transfer	1	1	0
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 (-2=minimal output to screen and no model_output_file ; -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
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

Parameter name	Description	Option	Number of Values	Data type	Default value
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 parameters dprst_frac_init , snowpack_init , segment_flow_init , elevlake_init , gwstor_init , and (soil_rechr_init , soil_moist_init , ssstor_init for model_mode =PRMS or GSFLOW) or (soil_rechr_init_frac , soil_moist_init_frac , ssstor_init_frac for model_mode =PRMS5 or GSFLOW5); 3=yes and use parameter snowpack_init ; 4=yes and use parameter elevlake_init ; 5=yes and use parameters (soil_rechr_init , soil_moist_init , ssstor_init for model_mode =PRMS or GSFLOW) or (soil_rechr_init_frac , soil_moist_init_frac , ssstor_init_frac for model_mode =PRMS5 or GSFLOW5); 6=yes and use parameter gwstor_init ; 7=yes and use parameter dprst_frac_init)	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	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
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	basinOutON_OFF = 1	basinOutVars	4	none

Parameter name	Description	Option	Number of Values	Data type	Default value
	Comma Separated Values (CSV) output file(s). Each variable is written to files in the order specified in basinOutVars 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; _meanyear.csv; _yearly.csv; _meanmonthly.csv; or _monthly.csv. Variables must be of type real or double				
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
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, 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); variables must be of type real or double.	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					
nhruOutBaseFileName ²	String to define the prefix for each nhru summary output file.	nhruOutON_OFF = 1 or 2	1	4	none
nhruOutON_OFF	Switch to specify whether or not nhru summary output files are generated (0=no; 1=yes; 2=yes and use values of nhm_id as column heading)	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 files(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 or 2	nhruOutVars	4	none
nhruOutVars	Number of variables to include in nhru summary output file(s)	nhruOutON_OFF = 1 or 2	1	1	0
nhruOut_format	Format of values (1=scientific notation with 4 significant digits (default); 2=2 decimal places; 3=3 decimal places; 4=4 decimal places; 5=5 decimal places)	nhruOutON_OFF = 1 or 2	1	1	1
nhruOut_freq	Output frequency and type (1=daily; 2=monthly; 3=both; 4=mean monthly; 5=mean yearly; 6=yearly)	nhruOutON_OFF = 1 or 2	1	1	1
Nsub Summary Results Files					

Parameter name	Description	Option	Number of Values	Data type	Default value
nsubOutBaseFileName²	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 generated (0=no; 1=yes)	nsub summary results	1	1	0
nsubOutVar_names	List of variable names for which output is written to nsub summary Comma Separated Values (CSV) output files(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_format	Format of values (1=scientific notation with 4 significant digits (default); 2=2 decimal places; 3=3 decimal places; 4=4 decimal places; 5=5 decimal places)	nsubOutON_OFF = 1	1	1	1
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
Nsegment Summary Results Files					
nsegmentOutBaseFileName³	String to define the prefix for each nsegment summary output file.	nsegmentOutON_OFF = 1 or 2	1	4	none
nsegmentOutON_OFF	Switch to specify whether or not nsegment summary output files are generated (0=no; 1=yes; 2=yes and use values of nhm_seg as column heading)	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 files(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; _meanyearly.csv; _yearly.csv; _meanmonthly.csv; or _monthly.csv. Variables must be of type real or double	nsegmentOutON_OFF = 1 or 2	nsubOutVars	4	none
nsegmentOutVars	Number of variables to include in nsegment summary output file(s)	nsegmentOutON_OFF = 1 or 2	1	1	0
nsegmentOut_format	Format of values (1=scientific notation with 4 significant digits (default); 2=2 decimal places; 3=3 decimal places; 4=4 decimal places; 5=5 decimal places)	nsegmentOutON_OFF = 1 or 2	1	1	1

Parameter name	Description	Option	Number of Values	Data type	Default value
nsegmentOut_freq	Output frequency and type (1=daily; 2=monthly; 3=both; 4=mean monthly; 5=mean yearly; 6=yearly)	nsegmentOutON_OFF = 1 or 2	1	1	1
PRMS Summary Results Files					
csvON_OFF	Switch to specify whether or not common-separated values (CSV) summary output files are generated (0=no; 1=yes)	PRMS summary results	1	1	0
csv_output_file ²	Pathname of CSV output file	csvON_OFF = 1	1	4	none
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 graph	ndispGraphs > 0	number of variables	4	none
executable_desc	Descriptive text to identify the PRMS executable	ndispGraphs > 0	1	4	MOWS executable
executable_model ²	Pathname (full or relative) of the PRMS 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.

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; POI, point-of-interest; >, 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**, **stream_temp_flag**, **strmtmp_humidity_flag**, and **mapOutON_OFF** defined in table 1-2; green highlight indicates new for PRMS-V; blue highlight indicates deprecated but retained for PRMS-IV downward compatibility; ~~striethrough~~ indicates items removed]

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_lon	Longitude of each HRU	nhru	real	degrees East	-360.0 to 360.0	-105.0	optional
hru_slope	Slope of each HRU	nhru	real	decimal fraction	0.0 to 10.0	0.0	required ⁶
hru_type⁵	Type of each HRU (0=inactive; 1=land; 2=lake; 3=swale)	nhru	integer	none	0 to 3	1	required
nhm_id	National Hydrologic Model HRU ID	nhru	integer	none	1 to 9999999	1	optional
nhm_seg	National Hydrologic Model segment ID	nsegment	integer	none	1 to 9999999	1	optional
parent_gw	Lumen index in parent model for each GWR	ngw	integer	none	1 to 9999999	1	optional
parent_hru	Lumen index in parent model for each HRU	nhru	integer	none	1 to 9999999	1	optional
parent_poigages	Lumen index in parent model for each POI gage	npoigages	integer	none	1 to 9999999	1	optional
parent_segment	Lumen index in parent model for each segment	nsegment	integer	none	1 to 9999999	1	optional

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
parent_ssr	Lumen index in parent model for each SSR	nssr	integer	none	1 to 9999999	1	optional
Measured input							
outlet_sta	Index of measured streamflow station corresponding to the basin outlet	one	integer	none	0 to nobs	0	nobs > 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	nobs > 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
Water Use input							
irr_type	Method of application of water for each application time-series (0=sprinkler (intercep applies); 1=furrow/drip (no intercept); 2=ignore)	nhru	real	none	0 to 2	0	nwateruse = 1
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 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
basin_tsta	Index of temperature station used to compute basin temperature values	one	integer	none	0 to ntemp	0	temp_module = temp_1sta, temp_sta , temp_dist2, or temp_laps

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
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, temp_sta, 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 Coordinate System	nhru	real	feet	-1.0E9 to 1.0E9	0.0	temp_module = temp_dist2 and/or precip_module = precip_dist2
lapsemex_max	Monthly (January to December) maximum lapse rate to constrain lowest maximum lapse rate based on historical daily air temperatures for all air temperature-	nmonths	real	temp_units /feet	-3.0 to 3.0	2.0	temp_module = temp_dist2

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
lapsemax_min	measurement stations 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, temp_sta, 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
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	nrain, nmonths	real	precip_units	-2.0 to 10.0	1.0	precip_module = precip_laps

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
padj_sn	multiplied times the lapse rate and negative factors are made positive and substituted for the computed lapse rate 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
potet_cbh_adj	Monthly (January to December) adjustment factor to potential evapotranspiration specified in CBH Files for each HRU	nhru, nmonths	real	decimal fraction	0.5 to 1.5	1.0	et_module = climate_hru
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
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

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
psta_xlong	Longitude of each precipitation measurement station, State Plane Coordinate System	nrain	real	feet	-1.0E9 to 1.0E9	0.0	xyz_dist 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_sta, temp_laps, temp_dist2, ide_dist or xyz_dist

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	model_mode = PRMS or GSFLOW
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_offset	Monthly (January to December) maximum air temperature when precipitation is assumed to be rain; if HRU air temperature is greater than or equal to tmax_allsnow plus this value, precipitation is rain	nhru, nmonths	real	temp_units	0.0 to 50.0	38.0	model_mode = PRMS5 or GSFLOW5
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,

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
							temp_sta, temp_laps, temp_dist2, ide_dist or xyz_dist
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	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		
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 and

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
	equation for the latitude (Y) coordinate				1.0E7		temp_module = xyz_dist
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	precip_module and temp_module = xyz_dist
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	precip_module and temp_module = xyz_dist
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	precip_module and temp_module = xyz_dist
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 or potet_pm_sta
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 nevapl > 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 is not specified in a CBH File
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

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
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 or potet_pm_sta
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 or potet_pm_sta
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
covden_win	Winter vegetation cover density for the major vegetation	nhru	real	decimal	0.0 to 1.0	0.5	required

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
snow_intcp	type in each HRU Snow interception storage capacity for the major vegetation type in each HRU	nhru	real	fraction 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 fraction	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	decimal fraction	0.0 to 1.0	1.0	required
snarea_thresh	Maximum threshold snowpack water equivalent below which the snow-covered-area curve is applied	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	decimal fraction	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	decimal fraction	0.0 to 1.0	0.2	srunoff_module = srunoff_carea
hru_percent_imperv²	Fraction of each HRU area that is impervious	nhru	real	decimal fraction	0.0 to 0.999	0.0	required
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 and model_mode = PRMS
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	0.0 to 0.999	0.0	dprst_flag = 1 and model_mode = PRMS or GSFLOW
dprst_frac	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	0.0 to 0.999	0.0	dprst_flag = 1 and model_mode = PRMS5 or GSFLOW5
dprst_frac_init	Fraction of maximum surface-depression storage that	nhru	real	decimal	0.0 to 1.0	0.5	dprst_flag = 1

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
dprst_frac_open	contains water at the start of a simulation Fraction of open surface-depression storage area within an HRU that can generate surface runoff as a function of storage volume	nhru	double	fraction 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 and model_mode = PRMS or GSFLOW
sro_to_dprst_perv	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 and model_mode = PRMS5 or GSFLOW5
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

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
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
soil_moist_init	Initial value of available water in capillary reservoir for each HRU	nhru	real	inches	0.0 to 10.0	3.0	model_mode = PRMS or GSFLOW
soil_moist_init_frac	Initial fraction of available water in the capillary reservoir (fraction of soil_moist_max for each HRU	nhru	real	decimal fraction	0.0 to 1.0	0.0	model_mode = PRMS5 or GSFLOW5
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	model_mode = PRMS or GSFLOW
soil_rechr_init_frac	Initial fraction of available water in the capillary reservoir where losses occur as both evaporation and transpiration (upper zone of capillary reservoir) for each HRU	nhru	real	decimal fraction	0.0 to 1.0	0.0	model_mode = PRMS5 or GSFLOW5
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	model_mode = PRMS or GSFLOW
soil_rechr_max_frac	Fraction of the capillary reservoir water-holding capacity (soil_moist_max) where losses occur as both evaporation and transpiration (upper zone of capillary reservoir) for each HRU	nhru	real	decimal fraction	0.00001 to 1.0	1.0	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	model_mode = PRMS or GSFLOW
ssstor_init_frac	Initial fraction of available water in the gravity plus preferential-flow reservoirs (fraction of sat_threshold) for each HRU	nssr	real	decimal fraction	0.0 to 1.0	0.0	required
gwflow_coef	Linear coefficient in the equation to compute	Groundwater flow ngw	real	fraction/day	0.0 to 0.5	0.015	required

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
gwsink_coef	groundwater discharge for each GWR 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
hru_segment	Segment index to which an HRU contributes lateral flows (surface runoff, interflow, and groundwater discharge)	Streamflow nhru	integer	none	0 to nsegment	0	strmflow_module = muskingum, strmflow_in_out, or muskingum_lake
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
obsin_segment	Index of measured streamflow station that replaces inflow to a segment	nsegment	integer	none	0 to nobs	0	strmflow_module = muskingum, strmflow_in_out, or muskingum_lake
obsout_segment	Index of measured streamflow station that replaces outflow from a segment	nsegment	integer	none	0 to nobs	0	strmflow_module = muskingum, strmflow_in_out, or muskingum_lake
segment_flow_init	Initial flow in each stream segment	nsegment	real	cfs	0 to 1.0E7	0.0	strmflow_module = muskingum, strmflow_in_out, or muskingum_lake
segment_type	Segment type (0=segment; 1= headwater; 2=lake; 3=replace inflow; 4=inbound to NHM; 5=outbound from NHM; 6=inbound to region; 7=outbound from region; 8=drains to ocean; 9=sink; 10=inbound from Great Lakes; 11=outbound to Great Lakes)	nsegment	integer	none	0 to 111	0	strmflow_module = muskingum, strmflow_in_out, or muskingum_lake
tosegment	Index of downstream segment to which the segment	nsegment	integer	none	-11 to	0	strmflow_module =

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
	streamflow flows; for segments that do not flow to another segment enter 0				1000000		muskingum, strmflow_in_out, or muskingum lake optional
tosegment_nhm	National Hydrologic Model downstream segment ID	nsegment	integer	none	0 to 9999999	0	
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
Stream Temperature							
albedo	Short-wave solar radiation reflected by streams	one	real	decimal fraction	0.0 to 1.0	0.2	stream_temp_flag = 1
alte	East bank topographic altitude of each segment	nsegment	real	radians	0.0 to 1.570796	0.0	stream_temp_flag = 1 and stream_temp_shade_flag = 0
altw	West bank topographic altitude of each segment	nsegment	real	radians	0.0 to 1.570796	0.0	stream_temp_flag = 1 and stream_temp_shade_flag = 0
azrh	Azimuth angle of each segment	nsegment	real	radians	-1.570796 to 1.570796	0.0	stream_temp_flag = 1 and stream_temp_shade_flag = 0
gw_tau	Average residence time in groundwater flow	nsegment	integer	days	1 to 365	365	stream_temp_flag = 1
lat_temp_adj	Correction factor to adjust the bias of the temperature of the lateral inflow	nsegment, nmonths	real	decimal fraction	0.0 to 1.0	0.7	stream_temp_flag = 1
maxiter_sntemp	Maximum number of Newton-Raphson iterations to compute stream temperature	one	integer	none	10 to 2000	1000	stream_temp_flag = 1
melt_temp	Temperature at which snowmelt enters a stream	one	real	degrees Celsius	0.0 to 10.0	1.5	stream_temp_flag = 1
seg_elev	Segment elevation at midpoint	nsegment	real	meters	-1000.0 to 30000.0	0.0	stream_temp_flag = 1
seg_humidity	Mean monthly humidity for each segment, used when values not input in CBH File	nsegment, nmonths	real	decimal fraction	0.0 to 1.0	0.7	stream_temp_flag = 1 and strmttemp_humidity_flag = 1
seg_humidity_sta	Index of humidity measurement station for each stream	nsegment	integer	none	0.0 to	0.7	stream_temp_flag =

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
	segment				nhumid		1 and strmttemp_humidity_ flag = 2
seg_lat	Latitude of each segmen	nsegment	real	degrees North	-90.0 to 90.0	40.0	stream_temp_flag = 1
seg_length	Length of each segmen	nsegment	real	meters	1.0 to 100000.0	1000.0	stream_temp_flag = 1
seg_slope	Bed slope of each segmen	nsegment	real	decimal fraction	0.0001 to 2.0	0.015	stream_temp_flag = 1
segshade_sum	Total shade fraction for summer vegetation for each segment	nsegment	real	decimal fraction	0.0 to 1.0	0.0	stream_temp_flag = 1 and stream_temp_shade_ flag = 1
segshade_win	Total shade fraction for winter vegetation for each segment	nsegment	real	decimal fraction	0.0 to 1.0	0.0	stream_temp_flag = 1 and stream_temp_shade_ flag = 1
ss_tau	Average residence time of subsurface interflow	nsegment	real	days	1 to 365	30	stream_temp_flag = 1
vce	East bank average vegetation crown width for each segment	nsegment	real	meters	0.0 to 15.0	0.0	stream_temp_flag = 1 and stream_temp_shade_ flag = 0
vcw	West bank average vegetation crown width for each segment	nsegment	real	meters	0.0 to 15.0	0.0	stream_temp_flag = 1 and stream_temp_shade_ flag = 0
vdemn	Minimum east bank vegetation density for each segment	nsegment	real	decimal fraction	0.0 to 1.0	0.0	stream_temp_flag = 1 and stream_temp_shade_ flag = 0
vdemx	Maximum east bank vegetation density for each segment	nsegment	real	decimal fraction	0.0 to 1.0	0.0	stream_temp_flag = 1 and stream_temp_shade_ flag = 0
vdwmn	Minimum west bank vegetation density for each segment	nsegment	real	decimal fraction	0.0 to 1.0	0.0	stream_temp_flag = 1 and stream_temp_shade_ flag = 0

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
vdwmx	Maximum west bank vegetation density for each segment	nsegment	real	decimal fraction	0.0 to 1.0	0.0	stream_temp_flag = 1 and stream_temp_shade_flag = 0
vhe	East bank average vegetation height for each segment	nsegment	real	meters	0.0 to 30.0	0.0	stream_temp_flag = 1 and stream_temp_shade_flag = 0
vhw	West bank average vegetation height for each segment	nsegment	real	meters	0.0 to 30.0	0.0	stream_temp_flag = 1 and stream_temp_shade_flag = 0
voc	East bank vegetation offset for each segment	nsegment	real	meters	0.0 to 100.0	0.0	stream_temp_flag = 1 and stream_temp_shade_flag = 0
vow	West bank vegetation offset for each segment	nsegment	real	meters	0.0 to 100.0	0.0	stream_temp_flag = 1 and stream_temp_shade_flag = 0
width_alpha	Alpha coefficient in power function for width calculation	nsegment	real	unknown	0.0001 to 2.0	0.015	stream_temp_flag = 1
width_m	M value in power function for width calculation	nsegment	real	unknown	0.0001 to 2.0	0.015	stream_temp_flag = 1
Lake routing							
elev_outflow	Elevation of the main outflow point for each lake using broad-crested weir routing	nlake	real	feet	-300.0 to 10,000.0	0.0	strmflow_module = muskingum_lake
elevlake_init	Initial lake surface elevation for each lake using broad-crested weir routing or gate opening routing	nlake	real	feet	-300.0 to 10,000.0	1.0	strmflow_module = muskingum_lake
gw_seep_coef	Linear coefficient in equation to compute lakebed seepage to the GWR and groundwater discharge to each lake using broad-crested weir routing or gate opening routing	ngw	real	fraction/day	0.001 to 0.05	0.015	strmflow_module = muskingum_lake
lake_coef	Coefficient in equation to route storage to streamflow for each lake using linear routing	nlake	real	fraction/day	0.0001 to 1.0	0.1	strmflow_module = muskingum_lake
lake_din1	Initial inflow to each lake using Puls or linear storage routing	nlake	real	cfs	0.0 to 1.0E7	0.1	strmflow_module = muskingum_lake
lake_evap_adj	Monthly (January to December) adjustment factor for potential ET for each lake	nhru	real	decimal fraction	0.5 to 1.0	1.0	strmflow_modu = muskingum_lake
lake_hru	Index of HRU for each lake	nlake	integer	none	0 to nhru	0	strmflow_module =

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
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	strmflow_module = muskingum_lake
lake_init	Initial storage in each lake using Puls or linear storage routing	nlake	real	cfs-days	0.0 to 1.0E7	0.0	strmflow_module = muskingum_lake
lake_out2	Switch to specify a second outflow point from each lake using gate opening routing (0=no; 1=yes)	nlake	integer	none	0 or 1	0	strmflow_module = muskingum_lake
lake_out2_a	Coefficient A in outflow equation for each lake with a second outlet using gate opening routing	nlake	real	cfs/feet	0.0 to 10,000.0	1.0	strmflow_module = muskingum_lake
lake_out2_b	Coefficient B in outflow equation for each lake with a second outlet using gate opening routing	nlake	real	cfs	0.0 to 10,000.0	100.0	strmflow_module = muskingum_lake
lake_qro	Initial daily mean outflow from each lake	nlake	real	cfs	0.0 to 1.0E7	0.1	strmflow_module = muskingum_lake
lake_seep_elev	Elevation over which lakebed seepage to the GWR occurs for lake HRUs using broad-crested weir routing or gate opening routing	nlake	real	feet	-300.0 to 10,000.0	1.0	strmflow_module = muskingum_lake
lake_segment_id	Index of lake associated with a segment	nsegment	integer	none	0 to nlake	0	strmflow_module = muskingum_lake and cascade_flag = 1
lake_type	Type of lake routing method (1=Puls routing; 2=linear routing; 3=flow through; 4=broad crested weir; 5=gate opening; and 6=measured flow)	nlake	integer	none	1 to 6	1	strmflow_module = muskingum_lake
lake_vol_init	Initial lake volume for each lake using broad-crested weir or gate opening routing	nlake	real	acre-feet	0.0 to 1.0E7	0.0	strmflow_module = muskingum_lake
nsos	Number of storage/outflow values in table for each lake using Puls routing	mxnsos, nlake	integer	none	0 to mxnsos	0	strmflow_module = muskingum_lake
o2	Outflow values in outflow/storage tables for each lake using Puls routing	mxnsos, nlake	real	cfs	0.0 to 1.0E7	0.0	strmflow_module = muskingum_lake
obsout_lake	Index of streamflow measurement station that specifies outflow from each lake using measured flow replacement	nlake	integer	none	0 to nobs	0	strmflow_module = muskingum_lake
rate_table	Rating table with stage (rows) and gate opening (cols) for rating table 1 for lakes using gate opening routing and nratetbl>0	nstage, ngate	real	cfs	-100.0 to 1,000.0	5.0	strmflow_module = muskingum_lake
rate_table2	Rating table with stage (rows) and gate opening (cols) for rating table 2 for lakes using gate opening routing and nratetbl>1	nstage2, ngate2	real	cfs	-100.0 to 1,000.0	5.0	strmflow_module = muskingum_lake
rate_table3	Rating table with stage (rows) and gate opening (cols) for rating table 3 for lakes using gate opening routing	nstage3, ngate3	real	cfs	-100.0 to 1,000.0	5.0	strmflow_module = muskingum_lake

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
rate_table4	and nratetbl >2 Rating table with stage (rows) and gate opening (cols) for rating table 4 for lakes using gate opening routing and nratetbl >3	nstage4 , ngate4	real	cfs	-100.0 to 1,000.0	5.0	strmflow_module = muskingum_lake
ratetbl_lake	Index of lake associated with each rating table for each lake using gate opening routing	nratetbl	integer	none	0 to nlake	0	strmflow_module = muskingum_lake
s2	Storage values in outflow/storage table for each lake using Puls routing	mxnsos , nlake	real	cfs	0.0 to 1.0E7	0.0	strmflow_module = muskingum_lake
tbl_gate	Gate openings for each column for rating table 1 for lakes using gate opening routing and nratetbl >0	ngate	real	inches	0.0 to 20.0	0.0	strmflow_module = muskingum_lake
tbl_gate2	Gate openings for each column for rating table 2 for lakes using gate opening routing and nratetbl >1	ngate2	real	inches	0.0 to 20.0	0.0	strmflow_module = muskingum_lake
tbl_gate3	Gate openings for each column for rating table 3 for lakes using gate opening routing and nratetbl >2	ngate3	real	inches	0.0 to 20.0	0.0	strmflow_module = muskingum_lake
tbl_gate4	Gate openings for each column for rating table 4 for lakes using gate opening routing and nratetbl >3	ngate4	real	inches	0.0 to 20.0	0.0	strmflow_module = muskingum_lake
tbl_stage	Stage values for each row for rating table 1 for lakes using gate opening routing and nratetbl >0	nstage	real	feet	-100.0 to 1,000.0	5.0	strmflow_module = muskingum_lake
tbl_stage2	Stage values for each row for rating table 2 for lakes using gate opening routing and nratetbl >1	nstage2	real	feet	-100.0 to 1,000.0	5.0	strmflow_module = muskingum_lake
tbl_stage3	Stage values for each row for rating table 3 for lakes using gate opening routing and nratetbl >2	nstage3	real	feet	-100.0 to 1,000.0	5.0	strmflow_module = muskingum_lake
tbl_stage4	Stage values for each row for rating table 4 for lakes using gate opening routing and nratetbl >3	nstage4	real	feet	-100.0 to 1,000.0	5.0	strmflow_module = muskingum_lake
weir_coef	Coefficient for lakes using broad-crested weir routing	nlake	real	none	2.0 to 3.0	2.7	strmflow_module = muskingum_lake
weir_len	Weir length for lakes using broad-crested weir routing	nlake	real	feet	1.0 to 1,000.0	5.0	strmflow_module = muskingum_lake
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
Subbasin parameters							
hru_subbasin	Index of subbasin assigned to each HRU	nhru	integer	none	0 to user defined	0	subbasin_flag = 1

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
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							
gvr_cell_id ⁹	Index of the grid cell associated with each gravity reservoir	nhrucell	integer	none	0 to ngwcell	0	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	mapOutON_OFF = 1
gvr_hru_id ⁹	Index of the HRU associated with each gravity reservoir	nhrucell	integer	none	0 to nhrucell	1	mapOutON_OFF = 1
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 centimeters; 3=inches to meters; as states or fluxes)	one	integer	none	0 to 3	0	mapOutON_OFF = 1
ncol	Number of columns for each row of the mapped results	one	integer	none	1 to 50000	1	mapOutON_OFF = 1
prms_warmup	Number of years to simulate before writing mapped results	one	integer	years	0 to user defined	1	mapOutON_OFF = 1 or nhruOutON_OFF = 1
Summary results CSV file parameters							
poi_gage_id	USGS stream gage for each POI gage	npoigages	string	none	user defined	0	npoigages > 0 and csvON_OFF = 1
poi_gage_segment	Segment index for each POI gage	npoigages	integer	none	0 to nsegment	0	npoigages > 0 and csvON_OFF = 1
poi_type	Type code for each POI gage	npoigages	integer	none	1	1	optional
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

Parameter name	Description	Dimension ¹	Type	Units	Range	Default	Required/condition
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	and ncascdgw > 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 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 5 (PRMS-V)**.

[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>gate_ht</i>	Height of the gate opening at each dam with a gate	inches	>=0.0	nratetbl
<i>humidity</i>	Relative humidity at each measurement station	percentage	0.0 to 1.0	nhumid
<i>lake_elev</i>	Elevation of each simulated lake surface	feet	unlimited	nlakeelev
<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	Langley's	>=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 5 (PRMS-V).**

[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; **green** highlight indicates new for PRMS-V **water_use_flag = 1 if segment transferON_OFF=1 or gwr_transferON_OFF=1 or external_transferON_OFF=1 or dprst_transferON_OFF=1 or lake_transferON_OFF=1 or nconsumed>0 or nwateruse>0**; ~~striketrough~~ indicates items removed]

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, potet_pt, or (stream_temp_flag = 1 and strmttemp_humidity_flag = 0)
<i>is_rain_day</i>	Flag to indicate if it is raining anywhere in the basin	one	none	integer	precip_module = ide_dist or xyz_dist
<i>lake_precip</i>	Total precipitation into each lake HRU	nlake	cfs	double	strmflow_module = muskingum_lake
<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>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_hru</i>	Minimum air temperature distributed to each HRU	nhru	temp_units	real	always

<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
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_tmax⁵</i>	Basin maximum air temperature for use with solar radiation calculations	one	temp_units	real	always
<i>solrad_tmin⁵</i>	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

Water Use

basin_hru_apply	Basin area-weighted average canopy_gain	one	inches	double	water_use_flag = 1
basin_net_apply	Basin area-weighted average <i>net_apply</i>	one	inches	double	water_use_flag = 1
canopy_gain	Transfer gain to the canopy reservoir for each HRU for each time step	nhru	cfs	real	water_use_flag = 1
canopy_gain_tot	Transfer gain to the canopy reservoir for each HRU for the simulation	nconsumed	cfs	real	water_use_flag = 1 and nconsumed > 0
consumed_gain	Transfer gain to each water-use consumption destination for each time step	nconsumed	cfs	real	<i>water_use_flag = 1 and nconsumed > 0</i>
consumed_gain_tot	Transfer gain to each water-use consumption destination for the simulation	nconsumed	cfs	real	<i>water_use_flag = 1 and nconsumed > 0</i>
dprst_gain	Transfer gain to surface-depression storage for each HRU for each time step	nhru	cfs	real	dprst_transferON_OFF = 1 and dprst_flag = 1
dprst_gain_tot	Transfer gain to surface-depression storage for each HRU for the simulation	nhru	cfs	real	dprst_transferON_OFF = 1 and dprst_flag = 1
dprst_transfer	Transfer flow rate from surface-depression storage for each HRU for each time step	nhru	cfs	real	dprst_transferON_OFF = 1 and dprst_flag = 1
dprst_transfer_tot	Transfer flow rate from surface-depression storage for each HRU for the simulation	nhru	cfs	real	dprst_transferON_OFF = 1 and dprst_flag = 1
external_gain	Transfer gain to each external location for each time step	nexternal	cfs	real	external_transferON_OFF = 1 and nexternal > 1
external_gain_tot	Transfer gain to each external location for the simulation	nexternal	cfs	real	external_transferON_OFF = 1 and nexternal > 1
external_transfer	Transfer flow rate from each external location for each time step	nexternal	cfs	real	external_transferON_OFF = 1 and nexternal > 1
external_transfer_tot	Transfer flow rate from each external location for the simulation	nexternal	cfs	real	external_transferON_OFF = 1 and nexternal > 1
gwr_gain	Transfer gain to the groundwater reservoir of each HRU for each time step	nhru	cfs	real	<i>water_use_flag = 1</i>
gwr_gain_tot	Transfer gain to the groundwater reservoir of each HRU for the simulation	nhru	cfs	real	<i>water_use_flag = 1</i>
gwr_transfer	Transfer flow rate from the groundwater reservoir of each HRU for each time step	nhru	cfs	real	gwr_transferON_OFF = 1
gwr_transfer_tot	Transfer flow rate from the groundwater reservoir of each HRU for the simulation	nhru	cfs	real	gwr_transferON_OFF = 1
lake_gain	Transfer gain to each lake HRU for each time step	nhru	cfs	real	<i>water_use_flag = 1 and strmflow_module = muskingum_lake</i>
lake_gain_tot	Transfer gain to each lake HRU for the simulation	nhru	cfs	real	<i>water_use_flag = 1 and</i>

lake_transfer	Transfer flow rate from each lake HRU for each time step	nhru	cfs	real	strmflow_module = muskingum_lake lake_transferON_OFF = 1 and
lake_transfer_tot	Transfer flow rate from each lake HRU for the simulation	nhru	cfs	real	strmflow_module = muskingum_lake lake_transferON_OFF = 1 and
net_apply	<i>canopy_gain</i> minus interception	nhru	inches	real	strmflow_module = muskingum_lake <i>water_use_flag</i> = 1
segment_gain	Transfer gain to each stream segment for each time step	nhru	cfs	real	<i>water_use_flag</i> = 1 and strmflow_module = muskingum, strmflow_in_out, or muskingum_lake
segment_gain_tot	Transfer gain to each stream segment for the simulation	nhru	cfs	real	<i>water_use_flag</i> = 1 and strmflow_module = muskingum, strmflow_in_out, or muskingum_lake
segmen_transfer	Transfer flow rate from each stream segment for each time step	nhru	cfs	real	segment_transferON_OFF = 1 and strmflow_module = muskingum, strmflow_in_out, or muskingum_lake
segment_transfer_tot	Transfer flow rate from each stream segment for the simulation	nhru	cfs	real	segment_transferON_OFF = 1 and strmflow_module = muskingum, strmflow_in_out, or muskingum_lake
soilzone_gain	Transfer gain to the capillary reservoir within the soilzone for each HRU for each time step	nhru	cfs	real	<i>water_use_flag</i> = 1
soilzone_gain_tot	Transfer gain to the capillary reservoir within the soilzone for each HRU for the simulation	nhru	cfs	real	<i>water_use_flag</i> = 1
total_canopy_gain	Transfer gains to all canopy reservoirs for each time step	one	cfs	double	<i>water_use_flag</i> = 1
total_consumed_gain	Transfer flow rates to all water-use consumption destinations for each time step	one	cfs	double	<i>water_use_flag</i> = 1
total_dprst_gain	Transfer gains to all surface-depression storage for each time step	one	cfs	double	<i>water_use_flag</i> = 1 and dprst_flag = 1
total_dprst_transfer	Transfer flow rates from all surface-depression storage for each time step	one	cfs	double	dprst_transferON_OFF = 1 and dprst_flag = 1

total_external_gain	Transfer gains to all external locations for each time step	one	cfs	double	<i>water_use_flag</i> = 1
total_external_transfer	Transfer flow rates from all external locations for each time step	one	cfs	double	external_transferON_OFF = 1 and nexternal > 1
total_gwr_gain	Transfer gains to all groundwater reservoir for each time step	one	cfs	double	<i>water_use_flag</i> = 1
total_gwr_transfer	Transfer flow rates from all groundwater reservoirs for each time step	one	cfs	double	<i>water_use_flag</i> = 1 and gwr_transferON_OFF = 1
total_lake_gain	Transfer gains to all lake HRUs for each time step	one	cfs	double	<i>water_use_flag</i> = 1 and strmflow_module = muskingum_lake
total_lake_transfer	Transfer flow rates from all lake HRUs for each time step	one	cfs	double	lake_transferON_OFF = 1 and strmflow_module = muskingum_lake
total_segment_gain	Transfer gains to all stream segments for each time step	one	cfs	double	<i>water_use_flag</i> = 1 and strmflow_module = muskingum, strmflow_in_out, or muskingum_lake
total_segment_transfer	Transfer flow rates from all stream segments for each time step	one	cfs	double	segment_transferON_OFF = 1 and strmflow_module = muskingum, strmflow_in_out, or muskingum_lake
total_soilzone_gain	Transfer gains to all capillary reservoirs for each time step	one	cfs	double	<i>water_use_flag</i> = 1
total_transfers	Transfer of all water-use transfers for each time step	one	cfs	double	<i>water_use_flag</i> = 1
transfesr_rate	Transfer of each water-use transfer for each time step	nwateruse	cfs	double	<i>water_use_flag</i> = 1
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
<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

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_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	nhru	inches	real	always

	percent on each HRU				
<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>scrw</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</i>	Snow depth at each measurement station	nsnow	inches	real	nsnow > 0
<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>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	nsb	inches	double	subbasin_flag = 1
<i>subinc_snowcov</i>	Area-weighted average snow-covered area from associated HRUs to each subbasin	nsb	decimal fraction	double	subbasin_flag = 1
<i>subinc_snowmelt</i>	Area-weighted average snowmelt from associated HRUs of each subbasin	nsb	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_fall_frost</i>	Basin area-weighted average fall frost	one	solar date	real	model_mode = FROST
<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_lakeevap</i>	Basin area-weighted average lake evaporation	one	inches	double		nlake > 0
<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_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_snowevap</i>	Basin area-weighted average evaporation and sublimation from snowpack	one	inches	double		always
<i>basin_spring_frost</i>	Basin area-weighted average spring frost	one	solar date	real		model_mode = FROST
<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>fall_frost</i>	The solar date (number of days after winter solstice) of the first killing frost of the fall	nhru	solar date	real		model_mode = FROST
<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_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>lake_evap</i>	Total evaporation from each lake HRU	nlake	cfs	double		nlake > 0
<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

perv_avail_et	Unsatisfied ET available to the capillary reservoir of each HRU	nhru	inches	real	always
seginc_potet	Area-weighted average potential ET for each segment from HRUs contributing flow to the segment	nsegment	inches	double	strmflow_module = muskingum, strmflow_in_out, or muskingum_lake
snow_evap	Evaporation and sublimation from snowpack on each HRU	nhru	inches	real	always
snowevap_aet_frac	Fraction of sublimation of AET for each HRU	nhru	decimal fraction	double	always
spring_frost	The solar date (number of days after winter solstice) of the last killing frost of the spring	nhru	solar date	real	model_mode = FROST
subinc_actet	Area-weighted average actual ET from associated HRUs to each subbasin	nsub	inches	double	subbasin_flag = 1
subinc_potet	Area-weighted average potential ET from associated HRUs to each subbasin	nsub	inches	double	subbasin_flag = 1
swale_actet	Evaporation from the gravity and preferential-flow reservoirs that exceeds sat_threshold	nhru	inches	real	always
tempc_dewpt	air temperature at dew point for each HRU	nhru	degrees Celsius	real	et_module = potet_pm, potet_pm_sta, or potet_pt
transp_on	Flag indicating whether transpiration is occurring (0=no; 1=yes)	nhru	none	integer	always
unused_potet	Unsatisfied potential evapotranspiration	nhru	inches	real	always
vp_actual	Actual vapor pressure for each HRU	nhru	kilopascals	real	et_module = potet_pm, potet_pm_sta, or potet_pt
vp_sat	Saturation vapor pressure for each HRU	nhru	kilopascals	real	et_module = potet_pm, potet_pm_sta, or potet_pt
vp_slope	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					
basin_cap_infil_tot	Basin area-weighted average infiltration with cascading flow into capillary reservoirs	one	inches	double	always
cap_upflow_max	Maximum infiltration and any cascading interflow and Dunnian surface runoff that can be added to capillary reservoir storage for each HRU	nhru	inches	real	always
cap_waterin	Infiltration and any cascading interflow and Dunnian surface runoff added to capillary reservoir storage for each HRU	nhru	inches	real	always
cascade_dunnianflow	Cascading Dunnian flow for each HRU	nhru	inches	real	cascade_flag = 1 and ncascade > 0
cascade_interflow	Cascading interflow for each HRU	nhru	inches	real	cascade_flag = 1 and ncascade > 0
basin_contrib_fraction	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	nsub	cfs	double	subbasin_flag = 1

<i>subinc_sroff</i>	Area-weighted average Hortonian plus Dunnian surface runoff from associated HRUs to each subbasin	nsub	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 depressions	one	inches	double	dprst_flag = 1
<i>basin_dprst_volop</i>	Basin area-weighted average storage volume in open surface depressions	one	inches	double	dprst_flag = 1
<i>dprst_area_clos</i>	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</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_perv</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_infil_tot</i>	Basin area-weighted average infiltration with cascading flow into	one	inches	double	always

<i>basin_cap_up_max</i>	capillary reservoirs 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_dunnianflow</i>	Basin area-weighted average cascading Dunnian flow	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	one	inches	double	always

	the stream network				
<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 of the maximum storage	one	decimal fraction	double	always
<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_ssin</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 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>epr_stor_frac</i>	Fraction of capillary reservoir storage of the maximum storage for each HRU	nhru	decimal fraction	real	always
<i>dunnian_flow</i>	Dunnian surface runoff that flows to the stream network for each HRU	nhru	inches	real	always

gvr_stor_frae	Fraction of gravity reservoir storage of the maximum storage for each HRU	nhru	decimal fraction	real	always
hru_sz_cascadeflow	Cascading interflow and Dunnian surface runoff from each HRU	nhru	inches	real	cascade_flag = 1 and ncascade > 0
interflow_max	Maximum interflow for each HRU	nhru	inches	real	always
pfr_stor_frae	Fraction of preferential flow reservoir storage of the maximum storage for each HRU	nhru	decimal fraction	real	always
pref_flow	Interflow from the preferential-flow reservoir that flows to the stream network for each HRU	nhru	inches	real	always
pref_flow_in	Infiltration and flow from gravity reservoir storage to the preferential-flow reservoir	nhru	inches	real	always
pref_flow_infil	Infiltration to the preferential-flow reservoir storage for each HRU	nhru	inches	real	always
pref_flow_max	Maximum storage of the preferential-flow reservoir for each HRU	nhru	inches	real	always
pref_flow_stor	Storage in preferential-flow reservoir for each HRU	nhru	inches	real	always
pref_flow_thrsh	Soil storage threshold defining storage between field capacity and maximum soil saturation minus the any' preferential-flow storage	nhru	inches	real	always
recharge	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
seginc_ssflow	Area-weighted average interflow for each segment from HRUs contributing flow to the segment	nsegment	cfs	double	nsegment > 0
slow_flow	Interflow from gravity reservoir that flows to the stream network for each HRU	nhru	inches	real	always
slow_stor	Storage of gravity reservoir for each HRU	nhru	inches	real	always
soil_lower	Storage in the lower zone of the capillary reservoir that is only available for transpiration for each HRU	nhru	inches	real	always
soil_lower_ratio	Water content ration in the lower zone of the capillary reservoir for each HRU	nhru	decimal fraction	real	always
soil_moist	Storage of capillary reservoir for each HRU	nhru	inches	real	always
soil_moist_frae	Fraction soil zone storage of the maximum storage for each HRU	nhru	decimal fraction	real	always
soil_moist_tot	Total soil-zone storage (<i>soil_moist</i> + <i>ssres_stor</i>) for each HRU	nhru	inches	real	always
soil_rechr	Storage for recharge zone (upper portion) of the capillary reservoir that is available for both evaporation and transpiration	nhru	inches	real	always
soil_rechr_ratio	Water content ration in the recharge zone of the capillary reservoir for each HRU	nhru	decimal fraction	real	always
soil_to_gw	Portion of excess flow to the capillary reservoir that drains to the associated GWR for each HRU	nhru	inches	real	always
soil_to_ssr	Portion of excess flow to the capillary reservoir that flows to the gravity reservoir for each HRU	nhru	inches	real	always

soil_zone_max	Maximum storage of all soil zone reservoirs	nhru	inches	real	always
ssr_to_gw	Drainage from the gravity-reservoir to the associated GWR for each HRU	nssr	inches	real	always
ssres_flow	Interflow from gravity and preferential-flow reservoirs to the stream network for each HRU	nssr	inches	real	always
ssres_in	Inflow to the gravity and preferential-flow reservoirs for each HRU	nssr	inches	real	always
ssres_stor	Storage in the gravity and preferential-flow reservoirs for each HRU	nssr	inches	real	always
sub_interflow	Area-weighted average interflow from associated HRUs to each subbasin and from upstream subbasins	nsub	cfs	double	subbasin_flag = 1
subinc_capstor_frac	Area-weighted average fraction of capillary reservoir water content storage for associated HRUs of each subbasin	nsub	decimal fraction	double	subbasin_flag = 1
subinc_interflow	Area-weighted average interflow from associated HRUs to each subbasin	nsub	cfs	double	subbasin_flag = 1
subinc_recharge	Area-weighted average recharge from associated HRUs to each subbasin	nsub	inches	double	subbasin_flag = 1
subinc_szstor_frac	Area-weighted average fraction of soil-zone water content storage for associated HRUs of each subbasin	nsub	decimal fraction	double	subbasin_flag = 1
upslope_dunnianflow	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
upslope_interflow	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
Groundwater flow					
basin_gwflow	Basin area-weighted average groundwater flow to the stream network	one	inches	double	always
basin_gwflow_cfs	Basin area-weighted average groundwater flow to the stream network	one	cfs	double	always
basin_gwflow_mo	Monthly basin area-weighted average groundwater discharge	one	inches	double	always
basin_gwflow_tot	Total simulation basin area-weighted average groundwater discharge	one	inches	double	always
basin_gwflow_yr	Yearly basin area-weighted average groundwater discharge	one	inches	double	always
basin_gwin	Basin area-weighted average inflow to GWRs	one	inches	double	always
basin_gwsink	Basin area-weighted average GWR outflow to the groundwater sink	one	inches	double	always
basin_gwstor	Basin area-weighted average storage in GWRs	one	inches	double	always
basin_gwstor_minarea_wb	Basin area-weighted average storage added to each GWR when storage is less than gwstor_min	one	inches	double	always
gw_upslope	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	print_debug > -2
<i>basin_cfs_tot</i>	Total simulation basin area-weighted average streamflow	one	cfs	double	print_debug > -2
<i>basin_cfs_yr</i>	Yearly total streamflow to stream network	one	cfs	double	print_debug > -2
<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	print_debug > -2
<i>basin_runoff_ratio_mo</i>	Monthly area-weighted average discharge/precipitation	one	decimal fraction	double	print_debug > -2
<i>basin_segment_storage</i>	Basin area-weighted average storage in the stream network	one	inches	double	strmflow_module = muskingum, or muskingum lake
<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	print_debug > -2
<i>basin_stflow_out</i>	Basin area-weighted average streamflow leaving through the stream network	one	inches	double	print_debug > -2
<i>basin_stflow_tot</i>	Total simulation basin area-weighted average simulated streamflow	one	inches	double	print_debug > -2
<i>basin_stflow_yr</i>	Yearly basin area-weighted average simulated streamflow	one	inches	double	print_debug > -2
<i>flow_headwater</i>	Total flow out of headwater segments (segment_type=1)	one	cfs	double	strmflow_module = muskingum, or

<i>flow_in_great_lakes</i>	Total flow out into model domain from Great Lakes (segment_type =10)	one	cfs	double	muskingum_lake, or strmflow_in_out strmflow_module = muskingum, or muskingum_lake, or strmflow_in_out
<i>flow_in_nation</i>	Total flow into model domain from Mexico or Canada (segment_type =4)	one	cfs	double	strmflow_module = muskingum, or muskingum_lake, or strmflow_in_out
<i>flow_in_region</i>	Total flow into region (segment_type =6)	one	cfs	double	strmflow_module = muskingum, or muskingum_lake, or strmflow_in_out
<i>flow_out</i>	Total flow out of model domain	one	cfs	double	strmflow_module = muskingum, or muskingum_lake, or strmflow_in_out
<i>flow_out_NHM</i>	Total flow out of model domain to Mexico or Canada (segment_type =5)	one	cfs	double	strmflow_module = muskingum, or muskingum_lake, or strmflow_in_out
<i>flow_out_region</i>	Total flow out of region (segment_type =7)	one	cfs	double	strmflow_module = muskingum, or muskingum_lake, or strmflow_in_out
<i>flow_replacement</i>	Total flow out from replacement flow (segment_type =3)	one	cfs	double	strmflow_module = muskingum, or muskingum_lake, or strmflow_in_out
<i>flow_terminus</i>	Total flow to terminus segments (segment_type =9)	one	cfs	double	strmflow_module = muskingum, or muskingum_lake, or strmflow_in_out
<i>flow_to_great_lakes</i>	Total flow to Great Lakes (segment_type =11)	one	cfs	double	strmflow_module = muskingum, or muskingum_lake, or strmflow_in_out
<i>flow_to_lakes</i>	Total flow to lakes (segment_type =2)	one	cfs	double	strmflow_module = muskingum, or

flow_to_ocean	Total flow to oceans (segment_type =8)	one	cfs	double	muskingum_lake, or strmflow_in_out strmflow_module = muskingum, or muskingum_lake, or strmflow_in_out
<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	print_debug > -2
<i>obs_runoff_tot</i>	Total simulation measured streamflow at basin outlet	one	cfs	double	print_debug > -2
<i>obs_runoff_yr</i>	Yearly measured streamflow at basin outlet	one	cfs	double	print_debug > -2
<i>obsq_inches</i>	Measured streamflow at specified outlet station	one	inches	double	print_debug > -2
<i>obsq_inches_mo</i>	Monthly measured streamflow at specified outlet station	one	inches	double	print_debug > -2
<i>obsq_inches_tot</i>	Total simulation basin area-weighted average measured streamflow at specified outlet station	one	inches	double	print_debug > -2
<i>obsq_inches_yr</i>	Yearly measured streamflow at specified outlet station	one	inches	double	print_debug > -2
<i>runoff</i>	Streamflow at each measurement station	nobs	runoff_units	real	nobs > 0
seg_ccov	Area-weighted average cloud cover fraction for each segment from HRUs contributing flow to the segment	nsegment	decimal fraction	real	stream_temp_flag = 1
seg_daylight	Hours of daylight	nsegment	hours	real	stream_temp_flag = 1
<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	strmflow_module = muskingum, or muskingum_lake , or strmflow_in_out
seg_humidi	Area-weighted average relative humidity for each segment from HRUs contributing flow to the segment	nsegment	decimal fraction	real	stream_temp_flag = 1
<i>seg_inflow</i>	Total flow entering a segment	nsegment	cfs	double	strmflow_module = muskingum, or muskingum_lake , or strmflow_in_out
<i>seg_lateral_inflow</i>	Lateral inflow entering a segment	nsegment	cfs	double	strmflow_module = muskingum, or muskingum_lake , or strmflow_in_out
seg_melt	Area-weighted average snowmelt for each segment from HRUs contributing flow to the segment	nsegment	inches	real	stream_temp_flag = 1
<i>seg_outflow</i>	Streamflow leaving a segment	nsegment	cfs	double	strmflow_module = muskingum, or

					muskingum_lake , or strmflow_in_out
seg_potet	HRU area-weighted average potential ET for each segmen	nsegment	inches	real	stream_temp_flag = 1
seg_rain	Area-weighted average rainfall for each segment from HRUs contributing flow to the segment	nsegment	inches	real	stream_temp_flag = 1
seg_shade	Area-weighted average shade fraction for each segment	nsegment	decimal fraction	real	stream_temp_flag = 1
seg_sroff	Area-weighted average surface runoff for each segment from HRUs contributing flow to the segment and upstream HRUs	nsegment	inches	double	strmflow_module = muskingum , or muskingum_lake , or strmflow_in_out
seg_ssflow	Area-weighted average interflow for each segment from HRUs contributing flow to the segment and upstream HRUs	nsegment	inches	double	strmflow_module = muskingum , or muskingum_lake , or strmflow_in_out
seg_tave_air	Area-weighted average air temperature for each segment from HRUs contributing flow to the segment	nsegment	degrees Celsius	real	stream_temp_flag = 1
seg_tave_gw	groundwater temperature	nsegment	degrees Celsius	real	stream_temp_flag = 1
seg_tave_lat	lateral flow temperature	nsegment	degrees Celsius	real	stream_temp_flag = 1
seg_tave_sroff	surface runoff temperature	nsegment	degrees Celsius	real	stream_temp_flag = 1
seg_tave_ss	subsurface temperature	nsegment	degrees Celsius	real	stream_temp_flag = 1
seg_tave_water	Computed daily mean stream temperature for each segment	nsegment	degrees Celsius	real	stream_temp_flag = 1
seg_upstream_inflow	Sum of inflow from upstream segments	nsegment	cfs	double	strmflow_module = muskingum , or muskingum_lake , or strmflow_in_out
seg_width	Width of each segment	nsegment	meters	real	stream_temp_flag = 1
segment_delta_flow	Cummulative flow minus flow out for each stream segment	nsegment	cfs	double	strmflow_module = muskingum or muskingum_lake
streamflow_cfs	Streamflow at each measurement station	nobs	cfs	double	nobs > 0
streamflow_cms	Streamflow at each measurement station	nobs	cms	double	nobs > 0
strm_seg_in³	Flow in stream segments as a result of cascading flow in each stream segment	nsegment	cfs	double	cascade_flag = 1 and ncascade > 0
sub_cfs	Total streamflow leaving each subbasin	nsb	cfs	double	subbasin_flag = 1
sub_cms	Total streamflow from each subbasin	nsb	cms	double	subbasin_flag = 1
sub_inq	Sum of streamflow from upstream subbasins to each subbasin	nsb	cfs	double	subbasin_flag = 1
Lake dynamics					
basin_2ndstflow	Streamflow from second output point for lake HRUs using gate opening routing	one	inches	double	strmflow_module = muskingum_lake

<i>basin_lake_seep</i>	Basin area-weighted average lake-bed seepage to GWRs	one	acre-feet	double	strmflow_module = muskingum_lake
<i>basin_lake_stor</i>	Basin volume-weighted average storage for all lakes using broad-crested weir or gate opening routing	one	inches	double	strmflow_module = muskingum_lake
<i>dinl</i>	Inflow to each lake HRU using Puls or linear storage routing	nlake	cfs	double	strmflow_module = muskingum_lake
<i>elevlake</i>	Surface elevation of each lake	nlake	feet	real	strmflow_module = muskingum_lake and nratetbl > 0
<i>gate_ht</i>	Height of the gate opening at each dam with a gate	nratetbl	inches	real	strmflow_module = muskingum_lake and nratetbl > 0
<i>gw_seep_lakein</i>	Groundwater discharge to each lake HRU for each GWR	ngw	acre-feet	double	strmflow_module = muskingum_lake
<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
<i>lake_2gw</i>	Total seepage from each lake using broad-crested weir or gate opening routing	nlake	cfs	double	strmflow_module = muskingum_lake
<i>lake_elev</i>	Elevation of each simulated lake surface	nlakeelev	feet	real	strmflow_module = muskingum_lake and nlakeelev > 0
lake_gwflow	Total groundflow into each lake	nlake	cfs	double	strmflow_module = muskingum_lake
<i>lake_inflow</i>	Total inflow to each lake	nlake	cfs	double	strmflow_module = muskingum_lake
<i>lake_interflow</i>	Total interflow into each lake	nlake	cfs	double	strmflow_module = muskingum_lake
<i>lake_invol</i>	Inflow to each lake using broad-crested weir or gate opening routing	nlake	acre-feet	double	strmflow_module = muskingum_lake
<i>lake_lateral_inflow</i>	Lateral inflow to each lake	nlake	cfs	double	strmflow_module = muskingum_lake
<i>lake_outcfs</i>	Streamflow leaving each lake, includes any second outlet flow	nlake	cfs	double	strmflow_module = muskingum_lake
<i>lake_outcms</i>	Streamflow leaving each lake, includes any second outlet flow	nlake	cms	double	strmflow_module = muskingum_lake

<i>lake_outflow</i>	Evaporation and seepage from each lake	nlake	cfs	double	strmflow_module = muskingum_lake
<i>lake_outq2</i>	Streamflow from second outlet for each lake with a second outlet	nlake	cfs	double	strmflow_module = muskingum_lake
<i>lake_outvol</i>	Outflow to each lake using broad-crested weir or gate opening routing	nlake	acre-feet	double	strmflow_module = muskingum_lake
<i>lake_outvol_ts</i>	Outflow from each lake using broad-crested weir or gate opening routing for the time step	nlake	acre-inches	double	strmflow_module = muskingum_lake
<i>lake_seep_in</i>	Total seepage into each lake using broad-crested weir or gate opening routing	nlake	cfs	double	strmflow_module = muskingum_lake
<i>lake_seepage</i>	Lake-bed seepage from each lake to the associated GWR	ngw	acre-feet	double	strmflow_module = muskingum_lake
<i>lake_seepage_gwr</i>	Net lake-bed seepage to associated GWR	ngw	inches	double	strmflow_module = muskingum_lake
<i>lake_sroff</i>	Total surface runoff into each lake	nlake	cfs	double	cascade_flag = 1
<i>lake_sto</i>	Storage in each lake using Puls or linear storage routing	nlake	cfs-days	double	strmflow_module = muskingum_lake
<i>lake_stream_in</i>	Total streamflow to each lake	nlake	cfs	double	strmflow_module = muskingum_lake
<i>lake_vol</i>	Storage in each lake using broad-crested weir or gate opening routing	nlake	acre-feet	double	strmflow_module = muskingum_lake
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-depresion 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>basin_surface_storage</i>	Basin area-weighted average storage in all water storage reservoirs	one	inches	double	csvON_OFF = 1
<i>basin_total_storage</i>	Basin area-weighted average storage in all water storage reservoirs	one	inches	double	csvON_OFF = 1
<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	nsub	inches	double	subbasin_flag = 1

<i>subinc_stor</i>	Area-weighted average total water content in storage reservoirs associated HRUs of each subbasin	nsub	inches	double	subbasin_flag = 1
<i>subinc_wb</i>	Water balance for each subbasin	nsub	inches	double	subbasin_flag = 1
<i>watbal_sum</i>	Water balance aggregate	one	inches	double	always

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.

