Replacement Tables for the Precipitation-Runoff Modeling System, Version 4 Documentation Report (Markstrom and others, 2015) up to Version 6.0.0

By Robert S. Regan, Steven L. Markstrom, Jacob H. LaFontaine, and Parker A. Norton.

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Introduction

These updated tables are part of the Precipitation Runoff Modeling System (PRMS) software release, version 6.0.0, January 22, 2025 (PRMS-6.0.0, Regan and others, 2025). The tables herein document the current modules, dimensions, and input and output parameters and variables available in PRMS version 6.0.0. These are replacements for tables 2, 1-1, 1-2, 1-3, 1-4, and 1-5 in Markstrom and others, 2015. A new table, not in Markstrom and others (2015), is also included with this software release to document variables that can be input in Climate-By-HRU (CBH) Files.

Modules, file names, and user input are identified by using Courier New font. Input parameters and dimensions are identified by using **bold** font. State and flux variables are identified by using *italic* font. Please see each of the table header notes for an explanation of how to identify version changes within the table (typically by text color). In tables, blue text indicates changes for PRMS-6.0.0; green text indicates changes for PRMS-5.2.1.1; red text indicates changes for PRMS-5.2.1; purple text indicates deprecated parameters that are retained for downward compatibility with PRMS version 4.

See also the paired file **Release_Notes_PRMS_6.0.0.pdf** that documents changes made to PRMS with each official release.

PRMS Processes, Modules, and Utility Routines

Hydrologic processes and simulation capabilities are encoded in a modular format. The available modules for PRMS version 6.0.0 are listed below. Blue text indicates changes for PRMS-6.0.0. This table is optional printed to the header of the **model_output_file**. For example, it can be found in file .\prms_6.0.0\projects\sagehen\output\sagehen.out when **print_debug** specified greater than `-1`.

U.S. Geological Survey
Precipitation-Runoff Modeling System (PRMS)
Version 6.0.0 01/22/2025

Process	Available Modules
Basin Definition:	basin
Cascading Flow:	cascade
Time Series Data:	obs, water_use_read, dynamic_param_read, dynamic_soil_param_read
Potet Solar Rad:	soltab
Temperature Dist:	temp_1sta, temp_laps, temp_dist2, climate_hru, temp_map
Precip Dist:	precip_1sta, precip_laps, precip_dist2, climate_hru, precip_map
Temp & Precip Dist:	xyz_dist, ide_dist
Solar Rad Dist:	ccsolrad, ddsolrad, climate_hru
Transpiration Dist:	transp_tindex, climate_hru, transp_frost
Potential ET:	potet_hamon, potet_jh, potet_pan, climate_hru, potet_hs, potet_pt, potet_pm, potet_pm_sta
Interception:	intcp
Snow & Glacr Dynam:	snowcomp, glacr_melt
Surface Runoff:	srunoff_smidx, srunoff_carea
Soil Zone:	soilzone
Groundwater:	gwflow
Streamflow Routing:	strmflow, strmflow_in_out, muskingum, muskingum_lake, muskingum_mann, segment_to_hru
Streamflow Charact:	strmflow_character
Stream Temperature:	stream_temp
Output Summary:	basin_sum, subbasin, map_results, prms_summary, nhru_summary, nsub_summary, water_balance, basin_summary, nsegment_summary
Preprocessing:	write_climate_hru, frost_date

Table 2. Description of modules implemented in the Precipitation-Runoff Modeling System (updated for PRMS-6.0.0)

[HRU, Hydrologic Response Unit; CBH, climate by HRU; blue text indicates new for PRMS-6.0.0; green text indicates new for PRMS-5.2.1.1]

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	Reads and makes available dynamic parameters by HRU from pre-processed files.
dynamic_soil_param_read	Reads and makes available impervious, surface-depresion storage, and soilzone dynamic parameters by HRU from pre-processed files and adjusts associated states; code taken from dynamic_parameter_read.
water_use_read	Reads 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. Note, each HRU uses data from a single station, but, multiple stations can be used in a model with each HRU assigned data from one of those stations.
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_map	Distributes maximum and minimum temperatures to each HRU by using time series temperature data using an area-weighted method and correction factors to each HRU.
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 minimum and maximum air temperature values for each HRU directly from pre-processed files.
	Precipitation distribution process
precip_1sta	Determines the form of precipitation and distributes it to each HRU by using monthly correction factors to account for differences in altitude, spatial variation, topography, and measurement gage efficiency and observed data from one station. Note, each HRU uses data from a single station, but, multiple stations can be used in a model with each HRU assigned data from one of those stations.
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.
precip_map	Distributes precipitation and determines form to each HRU by using time series precipitation data using an area-weighted method and correction factors to each HRU.
climate_hru	Reads distributed precipitation values for each HRU directly from pre-processed 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 minimum and maximum air temperature and precipitation values for each HRU directly from pre-processed 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 for each HRU directly from pre-processed 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 distributed transpiration values for each HRU directly from pre-processed 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); requires windspeed and humidity specified in CBH Files.
potet_pm_sta	Computes the potential evapotranspiration by using the Penman-Monteith formulation (Penman, 1948; Monteith, 1965); requires windspeed and humidity specified 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 for each HRU directly from pre-processed files.
Canopy Interception process	
intcp	Computes volume of intercepted precipitation, evaporation from intercepted precipitation, and throughfall (net precipitation) 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.

glacr_melt	Computes glacier dynamics using three linear reservoirs (snow, firn, ice) with time lapses and ability to advance or retreat according to volume-area scaling.
Surface runoff process	
srunoff_smidx	Computes surface runoff and infiltration for each HRU by using a nonlinear variable-source-area method allowing for cascading flow.
srunoff_carea	Computes surface runoff and infiltration for each HRU by using a linear variable-source-area method allowing for cascading flow.
Soil-zone process	
soilzone	Computes inflows to and outflows from the 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 (Linsley and others, 1982).
muskingum_lake	Computes flow in the stream network using the Muskingum routing method and flow and storage in on-channel lake using several methods.
muskingum_mann	Computes flow in the stream network using the Muskingum routing method with Manning's N equation.
routing	Computes common segment routing flows for modules strmflow_in_out and muskingum.
segment_to_hru	Routes stream segment outflow to pervious area of associated HRUs instead of to a segment.
stream_temp	Computes daily mean stream temperature for each stream segment in the stream network; module based on the Stream Network Temperature Model (SNTEMP, Theurer and others, 1984).
strmflow	Computes daily streamflow as the sum of surface runoff, shallow-subsurface flow (interflow), detention reservoir flow, and groundwater flow.
strmflow_character	Computes stream segment characteristics when stream_temp is active.
strmflow_in_out	Routes water between segments in the stream network by setting the outflow to the inflow.
Summary process	
basin_sum	Computes daily, monthly, yearly, and total flow summaries of volumes and flows for all HRUs.
basin_summary	Write user-selected results for variables 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 transp_frost 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	Writes 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 or 2.
nsegment_summary	Writes 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`	Writes 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, 2 or 3.
`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 (updated for PRMS-6.0.0)

[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; blue text indicates changes for PRMS-6.0.0. Note, a dimension is optional if there is no associated parameter specified in the Parameter File(s) or variable specified in the Data File.]

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
nhrucell	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
nlake_hrus	Number of lake HRUs	0	required when any HRU has **hru_type** specified equal to 2
nsegment	Number of stream-channel segments	0	**strmflow_module** = `muskingum_lake`, `muskingum`, `muskingum_mann`, 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]		
ncbh	Number of values specified in CBH Files (active HRUs)	0	**cbh_active_flag** = 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	required if **et_module** = `potet_pm_sta`
nlakeelev	Maximum number of lake elevations for any rating table data set	0	**strmflow_module** = `muskingum_lake`
nmap	Number of spatial units in mapped climate	0	**temp_module** = `temp_map` or **precip_module** = `precip_map`
nmap2hru	Number of intersections between HRUs and spatial units in mapped climate	0	**temp_module** = `temp_map` or **precip_module** = `precip_map`
nobs	Number of streamflow-measurement stations	0	replacement flow when **strmflow_module** = `muskingum_lake`, `muskingum`, `muskingum_mann`, 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`,

Dimension[3]	Description	Default	Required/Condition
			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**
nstreamtemp	Number of stream temperature measurement stations	0	optional
ntemp	Number of air-temperature-measurement stations	0	**temp_module** = temp_1sta, temp_sta, temp_laps, temp_dist2, ide_dist, or xyz_dist
nwateruse	Number of unique sources and destinations	0	Input of water-use information
nwind	Number of wind-speed measurement stations	0	required if **et_module** = potet_pm_sta
	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		
four	Number of glacier variables in integer array	4	**glacier_flag** = 1
ndays	Maximum number of days in a year	366	optional
nglres	Number of reservoirs in a glacier	3	**glacier_flag** = 1
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
seven	Number of glacier variables in real array	7	**glacier_flag** = 1

[1]All associated data specified in Data File can be used for calibration purposes. While the default value for these dimensions is 0, there must be at least one column of measured data in the Data File, which could be a column of zeros.
[2]Use of **nssr** and **ngw** not equal to **nhru** is deprecated.
[3]Dimensions 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 (updated for PRMS 6.0.0)

[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; PET, potential 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 on the appropriateness of the default values; blue text indicates changes for PRMS-6.0.0; green text indicates new for PRMS-5.2.1.1; red text indicates new for PRMS-5.2.1]

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`=version IV parameters; `PRMS5`=version V parameters; `FROST`=growing season for each HRU; `WRITE_CLIMATE`=write CBH files of minimum and maximum air temperature (variables *tmin* and *tmax* in units: **temp_units**); precipitation (variable *hru_ppt*, in units: **precip_units**); solar radiation (variable *swrad*, in units: Langleys/day); potential ET (variable *potet*, in units: inches/day); and/or transpiration flag (variable *transp_on*, in units: none); `POTET`=simulate processes in computation sequence to potential ET; `TRANSPIRE`=simulate processes in computation sequence to determine transpiration period; `DOCUMENTATION`=write files of all declared parameters and variables in the executable)	simulation mode selection	1	4	`PRMS5`
model_output_file[2]	Pathname for Water-Budget File for results module `basin_sum`	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	`0`
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`

Parameter name	Description	Option	Number of Values	Data type	Default value
	Module selection and simulation options				
bias_adjust_flag	Flag (0=no; 1=yes) to indicate if temperature adjusts are changed to (a) improve the calculation of precipitation temperature used to calculate the form of precipitation as rain, snow or mixed; (b) use offset parameters from minimum air temperature adjustment parameters to adjust maximum air temperatures as it is possible in automated calibration methods maximum air temperatures could be set less than minimum air temperature; (c) allow for persistent snowpacks by using the antecedent snowpack water equivalent instead of setting to 0.0 on first Julian day of the water year; (d) set the temperature of rain that is added to a snowpack to (tavgc+tmax_allrain_c)*0.5 instead of (tmaxc+tmax_allsnow_c)*0.5 for mixed precipitation events	optional	1	1	0
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
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
frozen_flag	Flag to indicate if continuous frozen ground index simulation is computed (0=no; 1=yes)	frozen ground	1	1	0
forcing_check_flag	Flag to indicate performance of precipitation and temperature checks for hru_ppt < 0.0, hru_rain < 0.0, hru_snow < 0.0, tmax < tmin, tminf < -150.0 and tmaxf > 200.0 (0=no; 1=yes).	optional	1	1	0
glacier_flag	Flag to indicate if glacier simulation is computed (0=no; 1=yes)	glacier	1	1	0
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
mbInit_flag	Flag to indicate initial mass balance of glaciers (0=no optimization; 1=use first year of climate data; 2=constant mass balance gradient above and below equilibrium line altitude (ELA)	**glacier_flag** = 1	1	1	0

Parameter name	Description	Option	Number of Values	Data type	Default value
precip_module	Module name for precipitation-distribution method (climate_hru, ide_dist, precip_1sta, precip_dist2, precip_laps, precip_map, or xyz_dist)	module selection	1	4	precip_1sta
seg2hru_flag	Flag to indicate use of segment_to_hru to apply streamflow to capillary reservoir of associated HRUs (0=no; 1=yes).	optional	1	1	0
snarea_curve_flag	Flag to specify snow depletion curve calculation method. (0=specify snow depletion curves with parameter **hru_deplcrv** and **snarea_curve**; 1=compute using parameters **snarea_a**, **snarea_b**, **snarea_c**, and **snarea_d**)	optional	1	1	0
snow_cloudcover_flag	Flag to indicate if radiation transmission is computed based on HRU-based variables or basin-wide variables as is done in previous model versions (0=use basin variables; 1=use HRU variables)	snow computations	1	1	0
snow_flag	Flag to indicate if snow and glacier (if active) computations are computed (1=yes; 0=no).	optional	1	1	1
soilzone_aet_flag	Flag to specify soil-water evapotranspiration (ET) compute method. (0=compute soil-water ET based on unsatisfied ET and old upper zone replenishment method; 1=based on PET and new replenishment method); set to 0 for downward compatibility of old models, though it is recommended setting to 1 for new models	optional	1	1	0
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
stream_temp_flag	Flag to specify whether to simulate stream temperature; **strmflow_module** must be set to muskingum, muskingum_mann, strmflow_in_out, or muskingum_lake	stream temperature	1	1	0
stream_temp_shade_flag	Flag to indicate how shade is used in the stream_temp module (0=compute shade; 1=specified constant)	stream temperature	1	1	0
strmflow_module	Module name for streamflow routing simulation method (strmflow, muskingum, muskingum_mann, strmflow_in_out, or muskingum_lake)	module selection	1	4	strmflow
strmtemp_humidity_flag	Flag to specify where humidity information is read from for use by the stream_temp module (0=CBH File specified by control	stream temperature	1	1	0

Parameter name	Description	Option	Number of Values	Data type	Default value
	parameter **humidity_day**; 1=parameter **seg_humidity**; 2=Data File with values assigned based on parameter **seg_humidity_sta**), **strmflow_module** must be set to `muskingum`, `muskingum_mann`, `strmflow_in_out`, or `muskingum_lake`				
subbasin_flag	Flag to indicate if internal subbasins 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`, `temp_map`, `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				
albedo_cbh_flag	Flag to specify whether to input snowpack albedo from a CBH file (`0`=no; `1`=yes)	input options	1	1	`0`
albedo_day[2]	Pathname of the CBH file of pre-processed snowpack albedo input data for each HRU to specify variable *albedo_hru* (units: decimal fraction)	input options	1	4	`albedo.day`
cbh_active_flag	Flag to specify whether to input values in CBH files for a specified number of HRUs less than **nhru**, such as only active HRUs (`0`=no; `1`=yes)	input options	1	1	`0`
~~**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`~~
cloud_cover_cbh_flag	Flag to specify whether to input cloud cover from a CBH file (`0`=no; `1`=yes)	input options	1	1	`0`
cloud_cover_day[2]	Pathname of the CBH file of pre-processed cloud cover input data for each HRU to specify variable *cloud_cover_cbh* (units: decimal fraction)	input options	1	4	`cloudcover.day`
humidity_cbh_flag	Flag to specify whether to input humidity from a CBH file (`0`=no; `1`=yes)	**et_module** = `potet_pm` or `potet_pt`, or **stream_temp_flag** = `1` and **strmtemp_humidity_flag** = `0`	1	1	`0`
humidity_day[2]	Pathname of the CBH file of pre-processed humidity input data for each HRU to specify variable *humidity_hru* (units: 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 the variable *orad* is specified as the last column of the **swrad_day** CBH file (0=no; 1=yes)	**solrad_module** = climate_hru	1	1	1
potet_day[2]	Pathname of the CBH file of pre-processed potential-ET input data for each HRU to specify variable *potet* (units: inches/day)	**et_module** = climate_hru	1	4	potet.day
precip_day[2]	Pathname of the CBH file of pre-processed precipitation input data for each HRU to specify variable *precip* (units based on value specified for parameter **precip_units)**	**precip_module** = climate_hru	1	4	precip.day
precip_map_file[2]	Pathname of pre-processed precipitation input data to be mapped to each HRU to specify variable *precip_map_values* (units based on value specified for parameter **precip_units)**	**precip_module** = precip_map	1	4	precip.map
swrad_day[2]	Pathname of the CBH file of pre-processed solar-radiation input data for each HRU to specify variable *swrad* (units: Langleys/day)	**solrad_module** = climate_hru	1	4	swrad.day
tmax_day[2]	Pathname of the CBH file of pre-processed maximum air temperature input data for each HRU to specify variable *tmaxf* (units based on value specified for parameter **temp_units)**	**temp_module** = climate_hru	1	4	tmax.day
tmin_day[2]	Pathname of the CBH file of pre-processed minimum air temperature input data for each HRU to specify variable *tminf* (units based on value specified for parameter **temp_units)**	**temp_module** = climate_hru	1	4	tmin.day
tmax_map_file[2]	Pathname of pre-processed maximum air temperature input data to be mapped to each HRU to specify variable *tmax_map_values* to set variable *tmaxf* (units: degrees Fahrenheit)	**temp_module** = temp_map	1	4	tmax.map
tmin_map_file[2]	Pathname of pre-processed minimum air temperature input data to be mapped to each HRU to specify variable *tmin_map_values* to set variable *tminf* (units: degrees Fahrenheit)	**temp_module** = temp_map	1	4	tmin.map
transp_day[2]	Pathname of the CBH file of pre-processed transpiration on or off flag for each HRU file to specify variable *transp_on* (units: none)	**transp_module** = climate_hru	1	4	transp.day
windspeed_cbh_flag	Flag to specify whether to input windspeed in a CBH file (0=no; 1=yes)	**et_module** = potet_pm	1	1	0
windspeed_day[2]	Pathname of the CBH file of pre-processed wind speed input data for each HRU to specify variable *windspeed_hru* (units: meters/second)	**et_module** = potet_pm	1	4	windspeed.day
		Dynamic Parameter Input			
covden_sum_dynamic[2]	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	dyncovden_sum
covden_win_dynamic[2]	Pathname of the time series of pre-processed values for winter plant-cover density used to set values of **covden_win** for each	**dyn_covden_flag =** 2 or 3	1	4	dyncovden_win

Parameter name	Description	Option	Number of Values	Data type	Default value
	HRU				
covtype_dynamic[2]	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[2]	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[2]	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 **dprst_frac_dynamic**; 2=file **dprst_depth_dynamic**; 3=both)	dynamic surface depression	1	1	0
dyn_fallfrost_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 **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, such as 3=file wrain_intcp_dynamic and srain_intcp_dynamic, but not snow_intcp_dynamic)	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,	dynamic potential ET	1	1	0

Parameter name	Description	Option	Number of Values	Data type	Default value
	respectively; 2=parameter **jh_coef_hru, pm_d_coef** used in potet_jh , potet_pm, and potet_pm_sta modules, respectively)				
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_snareathresh_flag	Flag to indicate if a time series of snow-area threshold values are input in Dynamic Parameter File **snareathresh_dynamic** (0=no; 1=yes)	dynamic snow-area threshold	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
dyn_transp_on_flag	Flag to indicate if a time series of variable *transp_on* are input in a Dynamic Parameter File (0=no; 1=file **transp_on_dynamic**)	dynamic transpiration active or inactive	1	1	0
dynamic_param_log_file	Pathname of the log file that summarizes dynamic parameter changes for parameters not related to soilzone and land surface	for all dynamic parameter input	1	4	dynamic_parameter.out
dynamic_soil_param_log_file[2]	Pathname of the log file that summarizes dynamic parameter changes for soilzone and land surface related parameters	for all dynamic parameter input	1	4	dynamic_soil_parameter.out
fallfrost_dynamic[2]	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[2]	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[2]	Pathname of the time series of pre-processed values for dynamic parameter **imperv_stor_max**	**dyn_imperv_flag =** 2 or 3	1	4	dynimpervstor

Parameter name	Description	Option	Number of Values	Data type	Default value
potet_coef_dynamic[2]	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[2]	Pathname of the time series of pre-processed values for dynamic parameter **rad_trncf**	**dyn_radtrncf_flag** = 1	1	4	dynradtrncf
snareathresh_dynamic[2]	Pathname of the time series of pre-processed values for dynamic parameter **snarea_thresh**	**dyn_snareathresh_flag** = 1 or 2	1	4	snarea_thresh_dynamic
snow_intcp_dynamic[2]	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[2]	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[2]	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[2]	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[2]	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[2]	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[2]	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[2]	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[2]	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
transp_on_dynamic[2]	Pathname of the time series of pre-processed values for dynamic variable *transp_on*	**dyn_transp_on_flag** = 1	1	4	dyntranspon
wrain_intcp_dynamic[2]	Pathname of the time series of pre-processed values for dynamic parameter **wrain_intcp**	**dyn_intcp_flag** = 1, 3, 5, or 7	1	4	dynwraininctp
		Water Use Input			
dprst_add_water_use	Flag to indicate to use time series of surface-depression to add flow rates from the **dprst_transfer_file** (0=no; 1=yes)	**dprst_transferON_OFF** = 1 and **dprst_flag** = 1	1	1	0
dprst_transfer_file[2]	Pathname of the time series of pre-processed flow rates for	**dprst_transferON_OFF** =	1	4	dprst.transfer

Parameter name	Description	Option	Number of Values	Data type	Default value
	transfers from surface-depression storage	1 and **dprst_flag** = 1			
dprst_transfer_water_use	Flag to indicate to use time series of surface-depression to remove flow rates from the **dprst_transfer_file** (0=no; 1=yes)	**dprst_transferON_OFF** = 1 and **dprst_flag** = 1	1	1	0
dprst_transferON_OFF	Flag to indicate to use time series of surface-depression transfer flow rates from the **dprst_transfer_file** (0=no; 1=yes)	surface depression transfer and **dprst_flag** = 1	1	1	0
external_transfer_file[2]	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[2]	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[2]	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[2]	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=warnings; 1=errors; 2=check parameters and then stop)	parameter validation check	1	1	0
print_debug[1]	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

Parameter name	Description	Option	Number of Values	Data type	Default value
stat_var_file[2]	Pathname for Statistics Variables File	**statsON_OFF** = 1	1	4	statvar.out
statsON_OFF	Switch to specify whether the Statistics Variables File is generated (0=no; 1=statvar text format; 2=CSV format)	**statsON_OFF** = 1	1	1	0
statVar_element	List of identification numbers corresponding to variables specified in **statVar_names** list (1 to variable's dimension size)	**statsON_OFF** = 1	**nstatVars**	4	none
statVar_names	List of variable names for which output is written to Statistics Variables File	**statsON_OFF** = 1	**nstatVars**	4	none
	Initial Condition Files				
init_vars_from_file	Flag to specify whether or not the Initial Conditions File is specified as an input file (0=no; 1=yes; 2=yes and use parameters **dprst_frac_init**, **snowpack_init**, **segment_flow_init**, **elevlake_init**, **gwstor_init**, (**soil_rechr_init**, **soil_moist_init**, **ssstor_init** for **model_mode**=PRMS) or (**soil_rechr_init_frac**, **soil_moist_init_frac**, **ssstor_init_frac** for **model_mode**=PRMS5), and **stream_tave_init**; 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 (**soil_rechr_init_frac**, **soil_moist_init_frac**, **ssstor_init_frac** for **model_mode**=PRMS5); 6=yes and use parameter **gwstor_init**; 7=yes and use parameter **dprst_frac_init**; 8=yes and use parameter **stream_tave_init**)	initial conditions	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 conditions	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 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**	**aniOutON_OFF** = 1	1	1	0

Parameter name	Description	Option	Number of Values	Data type	Default value
	list				
Basin Summary Results Files					
basinOutBaseFileName[2]	String to define the prefix for each basin summary output file.	**basinOutON_OFF** = 1	1	4	basinout_path
basinOutON_OFF	Switch to specify whether basin summary output files are generated (0=no; 1=yes)	**basin** summary results	1	1	0
basinOutVar_names	List of variable names for which output is written to basin summary Comma Separated Values (CSV) output file(s). Each variable is written to 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; _meanyearly.csv; _yearly.csv; _meanmonthly.csv; or _monthly.csv; variables must be of type real or double	**basinOutON_OFF** = 1	**basinOutVars**	4	none
basinOutVars	Number of variables to include in basin summary output file(s)	**basinOutON_OFF** = 1	1	1	0
basinOut_freq	Output frequency and type (1=daily; 2=monthly; 3=both; 4=mean monthly; 5=mean yearly; 6=yearly)	**basinOutON_OFF** = 1	1	1	1
Mapped Results Files					
mapOutON_OFF	Switch to specify whether 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					
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
nhruOutBaseFileName[2]	String to define the prefix for each **nhru** summary output file.	**nhruOutON_OFF** = 1 or 2	1	4	nhruout_path
nhruOutNcol	Number of columns written per line, which can be used to generate gridded output (0=all values for each timestep are written on a single line as in previous versions; >0 number of columns)	**nhruOutON_OFF** = 1 or 2	1	1	0
nhruOutON_OFF	Switch to specify whether **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

Parameter name	Description	Option	Number of Values	Data type	Default value
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; _meanyearly.csv; _yearly.csv; _meanmonthly.csv; or _monthly.csv	**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
outputSelectDatesON_OFF	Switch to indicate if **nhru_summary** output files are generated for a specified set of dates (0=no, output time series on basis of **nhruOut_freq**; 1=yes, specify dates in file specified by **selectDatesFileName**)	**nhru** summary results and **nhruOut_freq** = 1 or 3	1	1	0
selectDatesFileName[2]	String to define the filename of the set of dates to output values of **nhru_summary** output files in chronological order with dates specified as YEAR MONTH DAY with a space(s) and/or comma separating YEAR and MONTH and MONTH and DAY (e.g. `1959 09 01`)	**outputSelectDatesON_OFF** = 1	1	4	`selectDates.in`
write_binary_nhru_flag	Switch to specify whether to output `nhru_summary` values as binary files (0=no; 1=yes)	**nhruOutON_OFF** = 1 or 2	1	1	0
	Nsub Summary Results Files				
nsubOutBaseFileName[2]	String to define the prefix for each **nsub** summary output file.	**nsubOutON_OFF** = 1	1	4	`nsubout_path`
nsubOutON_OFF	Switch to specify whether **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. 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.	**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	**nsubOutON_OFF** = 1	1	1	1

Parameter name	Description	Option	Number of Values	Data type	Default value
	monthly; 5=mean yearly; 6=yearly)				
	Nsegment Summary Results Files				
nsegmentOutBaseFileName[2]	String to define the prefix for each **nsegment** summary output file.	**nsegmentOutON_OFF** = 1 or 2	1	4	nsegmentout_path
nsegmentOutON_OFF	Switch to specify whether **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; 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	**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
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 to output a Comma-Separated-Values (CSV) file with simulated flows with 4 decimal places for segments specified by **poi_gage_segment** and **poi_gage_id** (0=no; 1=yes, with date tag year-month-day followed by 51 basin variables and simulated flow as comma separated values; 2=yes, with data tag year month day followed by simulated flows as a spaced delimited file; 3=yes, with date tag year-month-day followed by simulated flows as comma separated values)	PRMS summary results	1	1	0
csv_output_file[2]	Pathname of CSV output file	**csvON_OFF** = 1, 2, or 3	1	4	prms_summary.csv

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

[1]File and screen output options for **print_debug**: 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.

[2]Pathnames 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 (updated for PRMS-6.0.0)

[HRU, hydrologic response unit; GWR, groundwater reservoir; cfs, cubic feet per second; cms, cubic meters per second; ET, evapotranspiration; Id, number of modeling unit; dday, degree-day, the amount a day's average temperature departed from 65 degrees Fahrenheit; km, kilometer; m, meters; POI, point-of-interest; ELA, equilibrium line altitude, >, 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**, and **mapOutON_OFF** defined in table 1-2; blue text indicates changes for PRMS-6.0.0; green text indicates new for PRMS-5.2.1.1: purple text indicates deprecated but retained for PRMS-IV backward compatibility]

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
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
hru_lon	Longitude of each HRU	**nhru**	real	degrees East	-180.0 to 180.0	-105.0	optional
hru_slope	Slope of each HRU	**nhru**	real	decimal fraction	0.0 to 10.0	0.0	required
hru_type[5]	Type of each HRU (0=inactive; 1=land; 2=lake; 3=swale; 4=glacier)	**nhru**	integer	none	0 to 4	1	required
nhm_id[6]	National Hydrologic Model HRU ID	**nhru**	integer	none	1 to 9999999	1	optional for nhru_summary
nhm_seg[6]	National Hydrologic Model segment ID	**nsegment**	integer	none	1 to 9999999	1	optional for nsegment_summary
parent_gw[6]	Index in parent model for each GWR	**ngw**	integer	none	1 to 9999999	1	optional
parent_hru[6]	Index in parent model for each HRU	**nhru**	integer	none	1 to 9999999	1	optional
parent_poigages[6]	Index in parent model for each POI gage	**npoigages**	integer	none	1 to 9999999	1	optional
parent_segment[6]	Index in parent model for each segment	**nsegment**	integer	none	1 to	1	optional

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
					9999999		
parent_ssr[6]	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 *rain_day* 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	Application method of irrigation water for each HRU (0=sprinkler method with interception only; 1=ditch/drip method with no interception; 2=ignore; 3=sprinkler across whole HRU with interception and throughfall; 4=sprinkler method with amount of water applied on the basis of cover density, such as a living filter), for options 1, 2, and 3 irrigation water is specified as an HRU-area weighted average value	**nhru**	integer	none	0 to 4	0	**nwateruse** > 1 and at least one water-use destination is the plant canopy, *dest_type* = 8
	Air temperature and precipitation distribution						
adjmix_rain	Monthly (January to December) multiplicative 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) multiplicative rain downscaling adjustment factor for each precipitation measurement station	**nrain, nmonths**	real	decimal fraction	-0.5 to 3.0	-0.4	**precip_module** = ide_dist or xyz_dist
adjust_snow	Monthly (January to December) multiplicative snow downscaling adjustment factor for each precipitation	**nrain, nmonths**	real	decimal fraction	-0.5 to 3.0	-0.4	**precip_module** = ide_dist or

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
	measurement station						xyz_dist
basin_tsta	Index of temperature station used to compute basin temperature values	**one**	integer	none	0 to **ntemp**	1	**temp_module** = temp_1sta, temp_sta, temp_dist2, or temp_laps
conv_flag	Elevation conversion flag (0=none; 1=feet to meters; 2=meters to feet)	**one**	integer	none	0 to 2	0	**precip_module** and **temp_module** = xyz_dist
cbh_hru_id	HRU identification number associated with each value in CBH File	**ncbh**	integer	none	1 to nhru	1	**cbh_active_flag** = 1
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
hru2map_id	HRU identification number for each HRU to mapped spatial units intersection	**nmap2hru**	integer	none	0 to **nmap**	0	**precip_module** = precip_map and/or **temp_module** = temp_map
hru2map_pct	Portion of HRU associated with each HRU to map intersection	**nmap2hru**	real	decimal fraction	0.0 to 1.0	0.0	**precip_module** = precip_map and/or **temp_module** = temp_map
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) of each HRU for the centroid in Albers projection	**nhru**	real	meters	-1.0E7 to 1.0E7	0.0	**precip_module** and **temp_module** = ide_dist or

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
							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) of each HRU for the centroid 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
lapsemax_max	Monthly (January to December) maximum lapse rate to constrain lowest maximum lapse rate based on historical daily air temperatures for all air temperature-measurement stations	**nmonths**	real	**temp_units**/ feet	-3.0 to 3.0	2.0	**temp_module** = temp_dist2
lapsemax_min	Monthly (January to December) maximum lapse rate to constrain lowest minimum lapse rate on the basis of historical daily air temperatures for all air temperature-measurement stations	**nmonths**	real	**temp_units**/ feet	-7.0 to -3.0	-6.5	**temp_module** = temp_dist2
lapsemin_max	Monthly (January to December) minimum lapse rate to constrain lowest maximum lapse rate on the basis of historical daily air temperatures for all air temperature-measurement stations	**nmonths**	real	**temp_units**/ feet	-2.0 to 4.0	3.0	**temp_module** = temp_dist2
lapsemin_min	Monthly (January to December) minimum lapse rate to constrain lowest minimum lapse rate on the basis of historical daily air temperatures for all air temperature-measurement stations	**nmonths**	real	**temp_units**/ feet	-7.0 to -3.0	-4.0	**temp_module** = temp_dist2
map2hru_id	Mapped spatial unit identification number for each HRU to map intersection	**nmap2hru**	integer	none	0 to **nhru**	0	**precip_module** = precip_map and/or **temp_module** = temp_map
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	**one**	integer	none	0 to **nrain**	0	**precip_module** =

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
	to use for distributing precipitation to an HRU						`precip_dist2`
max_tsta	Maximum number of air temperature measurement stations to use for distributing temperature to an 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 measurement 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 rain lapse rate computed between station **hru_psta** and station **hru_plaps**; positive factors are multiplied times the lapse rate and negative factors are made positive and substituted for the computed lapse rate	**nrain**, **nmonths**	real	**precip_units**	-2.0 to 10.0	1.0	**precip_module** = `precip_laps`
padj_sn	Monthly (January to December) factor to adjust snow 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) multiplicative 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`
ppt_zero_thresh	Precipitation below this amount is set to 0.0	**one**	real	**precip_units**	0.0 to 0.1	0.0	required
prcp_wght_dist	Monthly (January to December) precipitation weighting	**nmonths**	real	decimal	0.0 to 1.0	0.5	**precip_module** =

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
	function for inverse distance calculations			fraction			ide_dist
precip_map_adj	Monthly (January to December) multiplicative adjustment factor to mapped precipitation to account for differences in elevation, and so forth	**nmap, nmonths**	real	decimal fraction	0.5 to 2.0	1.0	**precip_module** = precip_map
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 applied 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	0.0	**precip_module** = ide_dist or xyz_dist
psta_xlong	Longitude of each precipitation measurement station, State Plane Coordinate System	**nrain**	real	feet	-1.0E9 to 1.0E9	0.0	**precip_module** = precip_dist2
psta_y	Latitude (Y) for each precipitation measurement station in Albers projection	**nrain**	real	meters	-1.0E7 to 1.0E7	0.0	**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) multiplicative factor to adjust measured rain on each HRU to account for differences in elevation, and so forth	**nhru**, **nmonths**	real	decimal fraction	0.2 to 10.0	1.0	**precip_module** = precip_1sta
rain_cbh_adj	Monthly (January to December) multiplicative 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 applied 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

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
snow_adj	Monthly (January to December) multiplicative factor to adjust measured snow on each HRU to account for differences in elevation, and so forth	**nhru, nmonths**	real	decimal fraction	0.2 to 5.0	1.0	**precip_module** = `precip_1sta`
snow_cbh_adj	Monthly (January to December) multiplicative 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 applied 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	Monthly (January to December) additive adjustment to maximum 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`
tmax_adj_offset	Monthly (January to December) additive adjustment to maximum temperature for each HRU as offset from tmin_adj, estimated on the basis of slope and aspect	**nhru, nmonths**	real	**temp_units**	0.0 to 50.0	0.0	**bias_adjust_flag** = 1 and **temp_module** = `temp_1sta`, `temp_sta`, `temp_laps`, `temp_dist2`, `ide_dist` or `xyz_dist`
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
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`

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
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	1.0	**model_mode** = `PRMS5`
tmax_allrain_sta	Monthly (January to December) maximum air temperature when precipitation is assumed to be rain; if 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	32.0	**temp_module** = `xyz_dist`
tmax_allsnow_sta	Monthly (January to December) maximum air temperature when precipitation is assumed to be snow; if 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) additive 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_cbh_adj_offset	Monthly (January to December) additive adjustment factor to maximum air temperature as an offset from **tmin_cbh_adj** for each HRU, estimated on the basis of slope and aspect	**nhru, nmonths**	real	**temp_units**	0.0 to 50.0	0.0	**bias_adjust_flag** = `1` and **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_map_adj	Monthly (January to December) additive adjustment factor to maximum air temperature for each mapped spatial unit estimated on the basis of slope and aspect	**nmap, nmonths**	real	**temp_units**	-10.0 to 10.0	0.0	**temp_module** = `temp_map`
tmax_map_adj_offset	Monthly (January to December) additive adjustment factor to maximum air temperature as an offset from **tmin_map_adj** for each mapped, spatial unit estimated on the basis of slope and aspect	**nmap, nmonths**	real	**temp_units**	0.0 to 50.0	0.0	**bias_adjust_flag** = `1` and **temp_module** = `temp_map`
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	**one**	real	**temp_units**	-100.0 to	0.0	**temp_module** =

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
	transformation equation for minimum air temperature				100.0		xyz_dist
tmin_adj	Adjustment to minimum air temperature for each HRU, estimated on the basis of slope and aspect	**nhru, nmonths**	real	**temp_units**	-10.0 to 10.0	0.0	**temp_module** = temp_1sta, temp_sta, temp_laps, temp_dist2, ide_dist or xyz_dist
tmin_cbh_adj	Monthly (January to December) additive 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_map_adj	Monthly (January to December) additive adjustment factor to minimum air temperature for each mapped spatial unit, estimated on the basis of slope and aspect	**nmap, nmonths**	real	**temp_units**	-10.0 to 10.0	0.0	**temp_module** = temp_map
tmin_lapse	Monthly (January to December) values representing the change in minimum air temperature per 1,000 **elev_units** of elevation change for each HRU	**nhru, nmonths**	real	**temp_units**/ **elev_units**	-20.0 to 20.0	3.0	**temp_module** = temp_1sta
tsta_elev	Elevation of each air-temperature-measurement station	**ntemp**	real	**elev_units**	-300.0 to 30,000.0	0.0	**temp_module** = temp_1sta, temp_dist2, or temp_laps
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,	**ntemp**	real	feet	-1.0E9 to	0.0	**temp_module** =

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
	State Plane Coordinate System				1.0E9		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 equation for the latitude (Y) coordinate	**one**	real	meters	-1.0E7 to 1.0E7	0.0	**precip_module** and **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**	0.1 to 1.4	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	**nhru, nmonths**	real	none	0.0 to 1.0	1.0	**solrad_module** = ddsolrad

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
	each HRU						
radadj_slope	Monthly (January to December) slope in air temperature range adjustment to degree-day equation for each HRU	**nhru, nmonths**	real	1/ **temp_units**	0.0 to 1.0	0.0	**solrad_module** = `ddsolrad`
radj_sppt	Multiplicative adjustment factor for computed solar radiation for summer day with greater than **ppt_rad_adj** inches of precipitation for each HRU	**nhru**	real	decimal fraction	0.0 to 1.0	0.44	required
radj_wppt	Multiplicative adjustment factor for computed solar radiation for winter day with greater than **ppt_rad_adj** inches of precipitation for each HRU	**nhru**	real	decimal fraction	0.0 to 1.0	0.5	required
radmax	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	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 **nevap** > 0
hru_windspeed_sta	Index of wind speed measurement station for each HRU	**nhru**	integer	none	0 to **nwind**	0	**et_module** = `potet_pm_sta` and **nwind** > 0
hs_krs	Monthly (January to December) multiplicative 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

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
							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	-0.5 to 1.5	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`
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) multiplicative 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) multiplicative 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 through the 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	**nhru**	real	**temp_units**	0.0 to 1,000.0	1.0	**transp_module** = `transp_tindex`

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
	first day of month **transp_beg**; when the sum exceeds this index, transpiration begins						
		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 type in each HRU	**nhru**	real	decimal fraction	0.0 to 1.0	0.5	required
snow_intcp	Snow interception storage capacity for the major vegetation type in each HRU	**nhru**	real	inches	0.0 to 1.0	0.1	required
srain_intcp	Summer rain interception storage capacity for the major vegetation type in each HRU	**nhru**	real	inches	0.0 to 1.0	0.1	required
wrain_intcp	Winter rain interception storage capacity for the major vegetation type in each HRU	**nhru**	real	inches	0.0 to 1.0	0.1	required
		Snow computations					
albset_rna	Fraction of rain in a mixed precipitation event above which the snow albedo is not reset; applied during the snowpack accumulation stage	**one**	real	decimal fraction	0.5 to 1.0	0.8	required
albset_rnm	Fraction of rain in a mixed precipitation event above which the snow albedo is not reset; applied during the snowpack melt stage	**one**	real	decimal fraction	0.4 to 1.0	0.6	required
albset_sna	Minimum snowfall, in water equivalent, needed to reset snow albedo during the snowpack accumulation stage	**one**	real	inches	0.01 to 1.0	0.05	required
albset_snm	Minimum snowfall, in water equivalent, needed to reset snow albedo during the snowpack melt stage	**one**	real	inches	0.1 to 1.0	0.2	required
cecn_coef	Monthly (January to December) convection condensation energy coefficient for each HRU	**nhru, nmonths**	real	calories per degree Celsius > 0	0.02.0 to 20.0	5.0	required
den_init	Initial density of new-fallen snow	**nhru**	real	grams/cubic centimeters	0.01 to 0.5	0.1	required
den_max	Average maximum snowpack density	**nhru**	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 (*pk_ice*) 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	**snarea_curve_flag**=0

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
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	**nhru**	real	decimal fraction	0.01 to 0.5	0.1	required
snarea_a	Snow area depletion curve minimum snow-water equivalent (SWE) value for each HRU	**nhru**	real	inches	0.0 to 1.0	0.0	**snarea_curve_flag**=1
snarea_b	Snow area depletion curve B coefficient used in computing values off an S curve for each HRU	**nhru**	real	none	0.5 to 20.0	2.0	**snarea_curve_flag**=1
snarea_c	Snow area depletion curve C coefficient used in computing values off an S curve for each HRU	**nhru**	real	none	0.001 to 3.0	1.5	**snarea_curve_flag**=1
snarea_d	Snow area depletion curve D coefficient used in computing values off an S curve for each HRU	**nhru**	real	none	0.0 to 3.0	0.975	**snarea_curve_flag**=1
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	**snarea_curve_flag**=0
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
			Glacier and frozen ground computations				
abl_elev_range	Average HRU snowfield ablation zones elevation range or approximate median-min elevation	**nhru**	real	**elev_units**	0.0 to 17000.0	1000.0	**glacier_flag** = 1
albedo_coef	Coefficient in calculation of ice albedo	**nhru**	real	none	0.1 to 0.3	0.137	**glacier_flag** = 1
albedo_ice	Ice albedo 300 meters below equilibrium line altitude (ELA)	**nhru**	real	decimal fraction	0.2 to 0.6	0.344	**glacier_flag** = 1
cfgi_decay	Continuous frozen ground index; daily decay of index; value of 1.0 is no decay	**one**	real	decimal fraction	0.1 to 1.0	0.97	**frozen_flag** = 1
cfgi_thrshld	Continuous frozen ground index threshold value indicating frozen soil	**one**	real	none	1.0 to 500.0	52.55	**frozen_flag** = 1
glacier_frac_init	Initial fraction of glaciation (0=none; 1=100%) in glacier-capable HRU	**nhru**	real	decimal fraction	0.0 to 1.0	0.0	**glacier_flag** = 1
glacr_freeh2o_cap	Free-water holding capacity of glacier ice of the frozen water content of the glacier ice (*glacr_pk_ice*)	**nhru**	real	decimal fraction	0.0 to 0.1	0.002	**glacier_flag** = 1
glacr_layer	Active layer is 0 to 15 m (590.6 inches) thick at start of	**nhru**	real	inches	0.0 to	0.0	**glacier_flag** = 1

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
	year, when melts will set daily *glacr_pk_temp* to 0				590.6		
glacrva_coef	Volume area scaling coefficient for glaciers, average value by region	**nhru**	real	m**(3-2***glacrva_exp**)	0.01 to 2.0	0.28	**glacier_flag** = 1
glacrva_exp	Volume area exponential coefficient for glaciers, average value by region	**nhru**	real	none	1.0 to 2.0	1.375	**glacier_flag** = 1
glrette_frac_init	Initial fraction of glacierette (too small for glacier dynamics)	**nhru**	real	decimal fraction	0.0 to 1.0	0.0	**glacier_flag** = 1
hru_length	Length of segment covering all of glacier-possible for each HRU	**nhru**	real	km	0.0 to 10000.0	0.0	**glacier_flag** = 1
hru_width	Width of glacier-possible for each HRU	**nhru**	real	km	0.0 to 10000.0	0.0	**glacier_flag** = 1
max_gldepth	Upper bound on glacier thickness, thickest glacier measured is Taku at 1.5 km, ice sheet 3 km	**nhru**	real	km	0.1 to 3.0	1.5	**glacier_flag** = 1
stor_firn	Monthly (January to December) storage coefficient for firn melt on glaciers	**nhru**	real	hours	150.0 to 1000.0	400.0	**glacier_flag** = 1
stor_ice	Monthly (January to December) storage coefficient for ice melt on glaciers	**nhru**	real	hours	5.0 to 29.0	10.0	**glacier_flag** = 1
stor_snow	Monthly (January to December) storage coefficient for snow melt on glaciers	**nhru**	real	hours	30.0 to 149.0	80.0	**glacier_flag** = 1
tohru	Index of down-flowline HRU to which the HRU glacier melt flows, for non-glacier HRUs that do not flow to another HRU enter 0	**nhru**	integer	none	0 to **nhru**	0	**glacier_flag** = 1
	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_imperv	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 5.0	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	**nhru**	real	acres	0.0 to 1.0E9	0.0	**dprst_flag** = 1 and **model_mode** = PRMS

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
	instead of **dprst_area**)						
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	0.5 to 1.5	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, default of -1.0 means use **dprst_area**)	**nhru**	real	decimal fraction	-1.0 to 0.999	-1.0	**dprst_flag** = 1 and **model_mode** = PRMS
dprst_frac	Fraction of each HRU area that has surface depressions	**nhru**	real	decimal fraction	0.0 to 0.999	0.0	**dprst_flag** = 1 and **model_mode** = PRMS5
dprst_frac_init	Fraction of maximum surface-depression storage that contains water at the start of a simulation	**nhru**	real	decimal fraction	0.0 to 1.0	0.5	**dprst_flag** = 1
dprst_frac_open	Fraction of open surface-depression storage area within an HRU that can generate surface runoff as a function of storage volume	**nhru**	double	decimal fraction	0.0 to 1.0	1.0	**dprst_flag** = 1
dprst_seep_rate_clos	Coefficient used in linear seepage flow equation for closed surface depressions for each HRU	**nhru**	real	fraction/day	0.0 to 0.2	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	0.0 to 0.2	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 the 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 the stream network for each HRU	**nhru**	real	decimal fraction	0.0 to 1.0	0.2	**dprst_flag** = 1 and **model_mode** = PRMS
sro_to_dprst_perv	Fraction of pervious surface runoff that flows into surface-depression storage; the remainder flows to the stream network for each HRU	**nhru**	real	decimal fraction	0.0 to 1.0	0.2	**dprst_flag** = 1 and **model_mode** = PRMS5
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 cylinder; 1.0 is a cone	**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	**nhru**	real	none	0.0001 to 10.0	0.001	**dprst_flag** = 1

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
	to compute current surface area for each HRU; 0.001 is an approximate cylinder; 1.0 is a cone						
	Soil zone storage, interflow, gravity drainage, Dunnian surface runoff						
fastcoef_lin	Linear coefficient in equation to route preferential-flow storage for each HRU	**nhru**	real	fraction/day	0.0 to 1.5	0.1	required
fastcoef_sq	Non-linear coefficient in equation to route preferential-flow storage for each HRU	**nhru**	real	none	0.0 to 1.0	0.8	required
pref_flow_den	Fraction of the gravity reservoir in which preferential flow occurs for each HRU	**nhru**	real	decimal fraction	0.0 to 0.5	0.0	required
pref_flow_infil_frac	Fraction of the soilwater infiltration partitioned to the preferential reservoir storage for each HRU (if not specified values are set to **pref_flow_den**)	**nhru**	real	decimal fraction	-1.0 to 1.0	-1.0	required
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	0.0 to 999.0	999.0	required
slowcoef_lin	Linear coefficient in equation to route gravity-reservoir storage for each HRU	**nhru**	real	fraction/day	0.0 to 1.0	0.015	required
slowcoef_sq	Non-linear coefficient in equation to route gravity-reservoir storage for each HRU	**nhru**	real	none	0.0 to 1.0	0.1	required
soil_moist_init	Initial value of available water in capillary reservoir for each HRU	**nhru**	real	inches	0.0 to 20.0	3.0	**model_mode** = PRMS
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
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	0.001 to 30.0	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 20.0	1.0	**model_mode** = PRMS
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
soil_rechr_max	Maximum storage for soil recharge zone (upper portion of capillary reservoir where losses occur as both evaporation and transpiration); must be less than or equal to **soil_moist_max**	**nhru**	real	inches	0.00001 to 30.0	1.5	**model_mode** = PRMS
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	**nhru**	real	decimal fraction	0.00001 to 1.0	1.0	**model_mode** = PRMS5

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
	each HRU						
soil2gw_max	Maximum amount of the capillary reservoir excess that is routed directly to groundwater storage 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 groundwater storage 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 groundwater storage 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 10.0	0.0	**model_mode** = `PRMS`
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	**model_mode** = `PRMS5`
	Groundwater flow						
gwflow_coef	Linear coefficient in the equation to compute groundwater discharge for each GWR	**ngw**	real	fraction/day	0.0 to 0.5	0.015	required
gwsink_coef	Linear coefficient in the equation to compute outflow to the groundwater sink for each GWR	**ngw**	real	fraction/day	0.0 to 1.0	0.0	required
gwstor_init	Storage in each GWR at the beginning of a simulation	**ngw**	real	inches	0.0 to 50.0	2.0	required
gwstor_min	Minimum storage in each GWR to ensure storage is greater than specified value to account for inflow from deep aquifers or injection wells with the water source outside the basin	**ngw**	real	inches	0.0 to 1.0	0.0	required
	Streamflow						
hru_segment	Segment index to which an HRU contributes lateral flows (surface runoff, interflow, and groundwater discharge)	**nhru**	integer	none	0 to **nsegment**	0	**strmflow_module** = `muskingum`, `strmflow_in_out`, `muskingum_lake`, or `muskingum_mann`
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`
mann_n	Manning's roughness coefficient for each segment	**nsegment**	real	none	0.001 to 0.15	0.04	**strmflow_module** = `muskingum_mann`
obsin_segment	Index of measured streamflow station that replaces inflow to a segment	**nsegment**	integer	none	0 to **nobs**	0	**strmflow_module** = `muskingum`,

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
							strmflow_in_out, muskingum_lake, or muskingum_mann
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, muskingum_lake, or muskingum_mann
seg_close	Index of closest segment from elevation and latitude for each a segment, if not specified, **seg_close** defaults to the upstream segment	**nsegment**	integer	none	-1 to **nsegment**	-1	**stream_temp_flag** = 1
seg_depth	Segment river depth at bank full; shallowest depth from Blackburn-Lynch (2017); Congo is deepest at 250 m but in the US, it is probably the Hudson at 66 m	**nsegment**	real	meters	0.03 to 250.0	1.0	**strmflow_module** = muskingum_mann
seg_length	Length of each segment	**nsegment**	real	meters	1.0 to 100000.0	1000.0	**strmflow_module** = muskingum_mann or **stream_temp_flag** = 1
seg_slope	Surface slope of each segment as approximation for bed slope of stream	**nsegment**	real	decimal fraction	0.0000001 to 2.0	0.0001	**strmflow_module** = muskingum_mann or **stream_temp_flag** = 1
segment_flow_init	Initial flow in each stream segment	**nsegment**	real	cfs	0 to 1.0E7	0.0	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
segment_outflow_id	Identification number of HRU that receives outflow from a segment	**nsegment**	integer	none	0 to **nhru**	0.0	**seg2hru_flag** = 1
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, add 100 to flag that the value is updated)	**nsegment**	integer	none	0 to 111	0	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
tosegment	Index of downstream segment to which the segment streamflow flows; for segments that do not flow to	**nsegment**	integer	none	0 to 9999999	0	**strmflow_module** =

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
	another segment enter 0						muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
tosegment_nhm	National Hydrologic Model downstream segment ID	**nsegment**	integer	none	0 to 9999999	0	optional
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 or muskingum_mann
	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) multiplicative adjustment factor for potential ET for each lake	**nhru**	real	decimal fraction	0.5 to 1.5	1.0	**strmflow_module** muskingum_lake
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	Flag 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	**nlake**	real	feet	-300.0 to	1.0	**strmflow_module** =

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
	for lake HRUs using broad-crested weir routing or gate opening routing				10,000.0		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 and **nratetbl**>2	**nstage3**, **ngate3**	real	cfs	-100.0 to 1,000.0	5.0	**strmflow_module** = muskingum_lake
rate_table4	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

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
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
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
		Stream temperature simulation					
albedo	Short-wave solar radiation reflected by streams	**one**	real	decimal fraction	0.0 to 1.0	0.1	**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
altw	West bank topographic altitude of each segment	**nsegment**	real	radians	0.0 to 1.570796	0.0	**stream_temp_flag** = 1
azrh	Azimuth angle of each segment	**nsegment**	real	radians	-1.570796 to 1.570796	0.0	**stream_temp_flag** = 1
depth_alpha	Alpha coefficient in power function for depth calculation (for units m and cms)	**nsegment**	real	meters	0.12 to 0.63	0.27	**stream_temp_flag** = 1
depth_m	M value in power function for depth calculation (for units m and cms)	**nsegment**	real	meters	0.38 to 0.4	0.39	**stream_temp_flag** = 1

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
gw_tau	Average residence time in groundwater flow	**nsegment**	integer	days	1 to 365	365	**stream_temp_flag** = 1
lat_temp_adj	Additive correction factor to adjust the bias of the temperature of the lateral inflow	**nsegment, nmonths**	real	degrees Celsius	-5.0 to 5.0	0.0	**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
seg_humidity_sta	Index of humidity measurement station for each stream segment	**nsegment**	integer	none	0 to **nhumid**	0	**stream_temp_flag** = 1 and `strmtemp_humidity_flag = 1`
seg_lat	Latitude of each segment	**nsegment**	real	degrees North	-90.0 to 90.0	40.0	**stream_temp_flag** = 1
segshade_sum	Total shade fraction for summer vegetation	**nsegment**	real	decimal fraction	0.0 to 1.0	0.0	**stream_temp_flag** = 1
segshade_win	Total shade fraction for winter vegetation	**nsegment**	real	decimal fraction	0.0 to 1.0	0.0	**stream_temp_flag** = 1
ss_tau	Average residence time of subsurface interflow	**nsegment**	integer	days	1 to 365	30	**stream_temp_flag** = 1
stream_tave_init	Initial average stream temperature in each segment at the beginning of a simulation	**nsegment**	real	degrees Celsius	-10.0 to 100.0	0.0	**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
tempIN_segment	Index of streamflow temperature in Data File that replaces temperature in a segment	**nsegment**	integer	none	0 to **nstreamtemp**	0	optional when **stream_temp_flag** = 1
vdemn	Minimum east bank vegetation density for each segment	**nsegment**	real	decimal fraction	0.0 to 1.0	0.0	**stream_temp_flag** = 1
vdemx	Maximum east bank vegetation density for each segment	**nsegment**	real	decimal fraction	0.0 to 1.0	0.0	**stream_temp_flag** = 1
vdwmn	Minimum west bank vegetation density for each segment	**nsegment**	real	decimal fraction	0.0 to 1.0	0.0	**stream_temp_flag** = 1
vdwmx	Maximum west bank vegetation density for each segment	**nsegment**	real	decimal fraction	0.0 to 1.0	0.0	**stream_temp_flag** = 1

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
vhe	East bank average vegetation height for each segment	**nsegment**	real	meters	0.0 to 30.0	0.0	**stream_temp_flag** = 1
vhw	West bank average vegetation height for each segment	**nsegment**	real	meters	0.0 to 30.0	0.0	**stream_temp_flag** = 1
voe	East bank vegetation offset for each segment	**nsegment**	real	meters	0.0 to 100.0	0.0	**stream_temp_flag** = 1
vow	West bank vegetation offset for each segment	**nsegment**	real	meters	0.0 to 100.0	0.0	**stream_temp_flag** = 1
width_alpha	Alpha coefficient in power function for width calculation (for units m and cms)	**nsegment**	real	meters	2.6 to 20.2	7.2	**stream_temp_flag** = 1
width_m	M value in power function for width calculation (for units m and cms)	**nsegment**	real	none	0.48 to 0.52	0.5	**stream_temp_flag** = 1
	Mapped results parameters						
gvr_cell_id	Index of the grid cell associated with each gravity reservoir	**nhrucell**	integer	none	0 to **ngwcell**	0	**mapOutON_OFF** = 1
gvr_cell_pct	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	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
	Summary results CSV file parameters						
poi_gage_id	USGS stream gage ID for each POI gage	**npoigages**	string	none	user defined	0	**npoigages** > 0 and **csvON_OFF** = 1, 2 or 3
poi_gage_segment	Segment index for each POI gage	**npoigages**	integer	none	0 to **nsegment**	0	**npoigages** > 0 and **csvON_OFF** = 1, 2 or 3
poi_type	Type code for each POI gage (0=non-calibration gage, 1=calibration gage, 2=flow replacement gage)	**npoigages**	integer	none	0 to 8	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

Parameter name	Description	Dimension[1]	Type	Units	Range	Default	Required/condition
							ncascdgw > 0
cascade_min	Minimum depth of interflow + Dunnian flow to cascade	**one**	real	inches	0.0 to 0.0	0.000001	**cascade_flag** = 1 and **ncascade** > 0 and/or **cascadegw_flag** = 1
cascade_tol	Cascade area below which a cascade link is ignored	**one**	real	acres	0.0 to 7.5% of **hru_area**	0.0	**cascade_flag** = 1 and **ncascade** > 0 and/or **cascadegw_flag** = 1 **ncascdgw** > 0
circle_switch	Switch to check for circles (0=no check; 1=check)	**one**	integer	none	0 or 1	1	**cascade_flag** = 1 and **ncascade** > 0 and/or **cascadegw_flag** = 1 **ncascdgw** > 0
gw_down_id[3]	Index number of the downslope GWR to which the upslope GWR contributes flow	**ncascdgw**	integer	none	0 to **ngw**	0	**cascadegw_flag** = 1 and **ncascdgw** > 0
gw_pct_up	Fraction of GWR area used to compute flow contributed to a downslope GWR or stream segment for cascade area	**ncascdgw**	real	decimal fraction	0.0 to 1.0	1.0	**cascadegw_flag** = 1 and **ncascdgw** > 0
gw_strmseg_down_id	Index number of the stream segment that cascade area contributes flow	**ncascdgw**	integer	none	0 to **nsegment**	0	**cascadegw_flag** = 1 and **ncascdgw** > 0
gw_up_id	Index of GWR containing cascade area	**ncascdgw**	integer	none	1 to **ngw**	0	**cascadegw_flag** = 1 and **ncascdgw** > 0
hru_down_id[4]	Index number of the downslope HRU to which the upslope HRU contributes flow	**ncascade**	integer	none	0 to **nhru**	0	**cascade_flag** = 1 and **ncascade** > 0
hru_pct_up	Fraction of HRU area used to compute flow contributed to a downslope HRU or stream segment for cascade area	**ncascade**	real	decimal fraction	0.0 to 1.0	1.0	**cascade_flag** = 1 and **ncascade** > 0
hru_strmseg_down_id	Index number of the stream segment that cascade area contributes flow	**ncascade**	integer	none	0 to **nsegment**	0	**cascade_flag** = 1 and **ncascade** > 0
hru_up_id	Index of HRU containing cascade area	**ncascade**	integer	none	0 to **nhru**	0	**cascade_flag** = 1 and **ncascade** > 0

[1]Dimensions defined in table 1-1.

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

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

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

[6]Parameter is not used by the code and exists for use in the National Hydrologic Model (NHM) PRMS application.

Table 1-4. Time-series input variables that may be included in the Data File for the Precipitation-Runoff Modeling System (updated for PRMS-6.0.0)

[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; blue text indicates changes for PRMS-6.0.0]

Variable	Definition	Units	Valid range	Dimension[1]
gate_ht	Height of the gate opening at each dam with a gate	inches	>=0.0	**nratetbl**
humidity	Relative humidity at each measurement station	percentage	0.0 to 1.0	**nhumid**
lake_elev	Elevation of each simulated lake surface	feet	unlimited	**nlakeelev**
pan_evap	Pan evaporation at each measurement station	inches	>=0.0	**nevap**
precip	Precipitation at each measurement station	**precip_units**	>=0.0	**nrain**
rain_day	Flag to set the form of any precipitation to rain (0=determine form; 1=rain)	none	0 or 1	**one**
runoff	Streamflow at each measurement station	**runoff_units**	>=0.0	**nobs**
snowdepth	Snow depth at each measurement station	inches	>=0.0	**nsnow**
solrad	Solar radiation at each measurement station	Langleys	>=0.0	**nsol**
stream_temp	Stream temperature at each measurement station	degrees Celsius	>=0.0	**nstreamtemp**
tmax	Maximum air temperature at each measurement station	**temp_units**	-150.0 to 200.0	**ntemp**
tmin	Minimum air temperature at each measurement station	**temp_units**	-150.0 to 200.0	**ntemp**
wind_speed	Wind speed at each measurement station	**meters per second**	0.0 to 500.0	**nwind**

[1]Dimensions defined in table 1-1.

Table 1-5. Input and output variables for the Precipitation-Runoff Modeling System (updated for PRMS 6.0.0)

[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; Ngl, number of glaciers counted by termini; Ntp, number of tops of glaciers; **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; ; blue text indicates changes for PRMS-6.0.0; green text indicates new for PRMS-5.2.1.1; red text indicates new for PRMS-5.2.1]

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

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
hru_rain	Rain distributed to each HRU	**nhru**	inches	real	always
hru_snow	Snow distributed to each HRU	**nhru**	inches	real	always
humidity	Relative humidity at each measurement station	**nhumid**	percentage	real	**nhumid** > 0
humidity_hru	Relative humidity for each HRU	**nhru**	percentage	real	**et_module** = `potet_pm`, or `potet_pt`
is_rain_day	Flag to indicate if it is raining anywhere in the basin	**one**	none	integer	**precip_module** = `ide_dist` or `xyz_dist`
lake_precip	Total precipitation into each lake HRU	**nlake**	cfs	double	**strmflow_module** = `muskingum_lake`
newsnow[2]	Flag to indicate if new snow fell on each HRU (`0`=no; `1`=yes)	**nhru**	none	integer	always
pptmix[2]	Flag to indicate if precipitation is a mixture of rain and snow for each HRU (`0`=no; `1`=yes)	**nhru**	none	integer	always
precip	Precipitation at each measurement station	**nrain**	**precip_units**	real	**nrain** > 0
prmx	Fraction of rain in a mixed precipitation event for each HRU	**nhru**	decimal fraction	real	always
subinc_precip	Area-weighted average precipitation on associated HRUs to each subbasin	**nsub**	inches	double	**subbasin_flag** = 1
subinc_rain	Area-weighted average rain from associated HRUs to each subbasin	**nsub**	inches	double	**subbasin_flag** = 1
subinc_snow	Area-weighted average snow on associated HRUs to each subbasin	**nsub**	inches	double	**subbasin_flag** = 1
subinc_tavgc	Area-weighted average air temperature for associated HRUs to each subbasin	**nsub**	degrees Celsius	double	**subbasin_flag** = 1
subinc_tmaxc	Area-weighted average maximum air temperature for associated HRUs to each subbasin	**nsub**	degrees Celsius	double	**subbasin_flag** = 1
subinc_tminc	Area-weighted average minimum air temperature for associated HRUs to each subbasin	**nsub**	degrees Celsius	double	**subbasin_flag** = 1
tavgc	Average air temperature distributed to each HRU	**nhru**	degrees Celsius	real	always
tavgf	Average air temperature distributed to each HRU	**nhru**	degrees Fahrenheit	real	always
tmax	Maximum air temperature at each measurement station	**ntemp**	**temp_units**	real	**ntemp** > 0
tmax_rain_sta	Maximum air temperature distributed to the precipitation stations	**nrain**	degrees Fahrenheit	real	**precip_module** = `ide_dist` or `xyz_dist`
tmaxc	Maximum air temperature distributed to each HRU	**nhru**	degrees Celsius	real	always
tmaxf	Maximum air temperature distributed to each HRU	**nhru**	degrees Fahrenheit	real	always
tmin	Minimum air temperature at each measurement station	**ntemp**	**temp_units**	real	**ntemp** > 0
tmin_rain_sta	Minimum air temperature distributed to the precipitation measurement stations	**nrain**	degrees Fahrenheit	real	**precip_module** = `ide_dist` or `xyz_dist`

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
tminc	Minimum air temperature distributed to each HRU	**nhru**	degrees Celsius	real	always
tminf	Minimum air temperature distributed to each HRU	**nhru**	degrees Fahrenheit	real	always
wind_speed	Wind speed at each measurement station	**nwind**	miles per hour	real	**nwind** > 0
wind_speed_hru	Wind speed for each HRU	**nhru**	miles per hour	real	**et_module** = potet_pm
		Solar radiation distribution			
basin_cloud_cover	Basin area-weighted average cloud cover proportion	**one**	decimal fraction	double	**solrad_module** = ccsolrad
basin_horad	Potential shortwave radiation for the basin centroid	**one**	Langleys	double	always
basin_orad	Basin area-weighted average shortwave radiation on a horizontal surface	**one**	Langleys	double	**solrad_module** = ccsolrad or ddsolrad
basin_potsw	Basin area-weighted average shortwave radiation	**one**	Langleys	double	always
basin_radadj	Basin area-weighted average potential radiation adjustment for cloud cover	**one**	decimal fraction	double	**solrad_module** = ccsolrad
basin_swrad	Basin area-weighted average shortwave radiation	**one**	Langleys	double	always
cloud_cover_hru	Cloud cover proportion of each HRU	**nhru**	decimal fraction	double	**solrad_module** = ccsolrad
cloud_cover_cbh	Cloud_cover of each HRU read from CBH File	**nhru**	decimal fraction	**real**	**cloud_cover_cbh_flag** = 1
cloud_radadj	Radiation adjustment for cloud cover of each HRU	**nhru**	decimal fraction	double	**solrad_module** = ccsolrad
lwrad_net	Net long-wave radiation for each HRU	**nhru**	Megajoules/m**2/day	real	**et_module** = potet_pm, potet_pm_sta, or potet_pt
orad	Measured or computed solar radiation on a horizontal surface	**one**	Langleys	real	**solrad_module** = ccsolrad or ddsolrad
orad_hru	Solar radiation on a horizontal surface for each HRU	**one**	Langleys	double	**solrad_module** = ccsolrad or ddsolrad
seginc_swrad[6]	Area-weighted average solar radiation for each segment from HRUs contributing flow to the segment	**nsegment**	Langleys	double	**nsegment** > 0
solrad	Solar radiation at each measurement station	**nsol**	Langleys	real	**nsol** > 0
solrad_tmax[5]	Basin maximum air temperature for use with solar radiation calculations	**one**	**temp_units**	real	always
solrad_tmin[5]	Basin minimum air temperature for use with solar radiation calculations	**one**	**temp_units**	real	always
subinc_swrad	Area-weighted average shortwave radiation distributed to associated HRUs of each subbasin	**nsub**	Langleys	double	**subbasin_flag** = 1
swrad	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 net application	**one**	inches	double	**water_use_flag** = 1

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
canopy_gain	Transfer gains to the canopy reservoir for each HRU for each time step	**nhru**	cfs	real	**water_use_flag** = 1
canopy_gain_tot	Transfer gains to the canopy reservoir for each HRU for the simulation	**nhru**	cfs	real	**water_use_flag** = 1 and **nconsumed** > 0
consumed_gain	Transfer gains to each water-use consumption destination for each time step	**nconsumed**	cfs	real	**water_use_flag** = 1 and **nconsumed** > 0
consumed_gain_tot	Transfer gains to each water-use consumption destination for the simulation	**nconsumed**	cfs	real	**water_use_flag** = 1 and **nconsumed** > 0
dprst_gain	Transfer gains 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 gains 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 gains to each external location for each time step	**nexternal**	cfs	real	**external_transferON_OFF** = 1 and **nexternal** > 1
external_gain_tot	Transfer gains 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
gain_inches	*canopy_gain* as depth in canopy	**nhru**	inches	real	**water_use_flag** = 1
gain_inches_hru	*canopy_gain* in canopy as depth over the HRU	**nhru**	inches	real	**water_use_flag** = 1
gwr_gain	Transfer gains to the groundwater reservoir of each HRU for each time step	**nhru**	cfs	real	**water_use_flag** = 1
gwr_gain _tot	Transfer gains to the groundwater reservoir of each HRU for the simulation	**nhru**	cfs	real	**water_use_flag** = 1
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 gains to each lake HRU for each time step	**nhru**	cfs	real	**water_use_flag** = 1 and **strmflow_module** =

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
					muskingum_lake
lake_gain _tot	Transfer gains to each lake HRU for the simulation	**nhru**	cfs	real	**water_use_flag** = 1 and **strmflow_module** = muskingum_lake
lake_transfer	Transfer flow rate from each lake HRU for each time step	**nhru**	cfs	real	**lake_transferON_OFF** = 1 and **strmflow_module** = muskingum_lake
lake_transfer_tot	Transfer flow rate from each lake HRU for the simulation	**nhru**	cfs	real	**lake_transferON_OFF** = 1 and **strmflow_module** = muskingum_lake
net_apply	*canopy_gain* minus interception	**nhru**	inches	real	**water_use_flag** = 1
segment_gain	Transfer gains to each stream segment for each time step	**nhru**	cfs	real	**water_use_flag** = 1 and **strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
segment_gain _tot	Transfer gains to each stream segment for the simulation	**nhru**	cfs	real	**water_use_flag** = 1 and **strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
segment_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, muskingum_lake, or muskingum_mann
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, muskingum_lake, or muskingum_mann
soilzone_gain	Transfer gains to the capillary reservoir within the soilzone for each HRU for each time step	**nhru**	cfs	real	**water_use_flag** = 1

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
soilzone_gain_hru	Irrigation added to soilzone as depth over each HRU	**nhru**	inches	real	**water_use_flag** = 1
soilzone_gain _tot	Transfer gains to the capillary reservoir within the soilzone for each HRU for the simulation	**nhru**	cfs	real	**water_use_flag** = 1
total_canopy_gain	Transfer gains to all canopy reservoirs for each time step	**one**	cfs	double	**water_use_flag** = 1
total_consumed_gain	Transfer flow rates to all water-use consumption destinations for each time step	**one**	cfs	double	**water_use_flag** = 1
total_dprst_gain	Transfer gains to all surface-depression storage for each time step	**one**	cfs	double	**water_use_flag** = 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	**water_use_flag** = 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 reservoirs for each time step	**one**	cfs	double	**water_use_flag** = 1
total_gwr_transfer	Transfer flow rates from all groundwater reservoirs for each time step	**one**	cfs	double	**water_use_flag** = 1 and **gwr_transferON_OFF** = 1
total_lake_gain	Transfer gains to all lake HRUs for each time step	**one**	cfs	double	**water_use_flag** = 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	**water_use_flag** = 1 and **strmflow_module** = `muskingum`, `strmflow_in_out`, `muskingum_lake`, or `muskingum_mann`
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`, `muskingum_lake`, or `muskingum_mann`
total_soilzone_gain	Transfer gains to all capillary reservoirs for each time step	**one**	cfs	double	**water_use_flag** = 1
total_transfers	Transfer of all water-use transfers for each time step	**one**	cfs	double	**water_use_flag** = 1

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
transfesr_rate	Transfer of each water-use transfer for each time step	**nwateruse**	cfs	double	**water_use_flag** = 1
			Interception		
basin_changeover	Basin area-weighted average water released from a change over of canopy cover type	**one**	inches	double	always
basin_intcp_stor	Basin area-weighted average interception storage	**one**	inches	double	always
basin_net_rain	Basin area-weighted average rain net precipitation	**one**	inches	double	always
basin_net_snow	Basin area-weighted average snow net precipitation	**one**	inches	double	always
canopy_covden	Canopy cover density for each HRU	**nhru**	decimal fraction	real	always
hru_intcpstor	Interception storage in the canopy for each HRU	**nhru**	inches	real	always
intcp_changeover	Water released from a change over of canopy cover type for each HRU	**nhru**	inches	real	always
intcp_form	Form (0=rain; 1=snow) of interception for each HRU	**nhru**	none	integer	always
intcp_on	Flag indicating interception storage for each HRU (0=no; 1=yes)	**nhru**	none	integer	always
intcp_stor	Interception storage in canopy for cover density for each HRU	**nhru**	inches	real	always
net_ppt	Precipitation (rain and/or snow) that falls through the canopy for each HRU	**nhru**	inches	real	always
net_rain	Rain that falls through canopy for each HRU	**nhru**	inches	real	always
net_snow	Snow that falls through canopy for each HRU	**nhru**	inches	real	always
			Snow computations		
ai	Maximum snowpack for each HRU	**nhru**	inches	real	always
albedo	Snow surface albedo or the fraction of radiation reflected from the snowpack surface for each HRU	**nhru**	decimal fraction	real	always
albedo_hru	Snowpack albedo of each HRU read from CBH File	**nhru**	decimal fraction	real	**albedo_cbh_flag** = 1
basin_pk_precip	Basin area-weighted average precipitation added to snowpack	**one**	inches	double	always
basin_pweqv	Basin area-weighted average snowpack water equivalent (not including glacier)	**one**	inches	double	always
basin_snowcov	Basin area-weighted average snow-covered area	**one**	decimal fraction	double	always
basin_snowmelt	Basin area-weighted average snowmelt (not on including snow on glacier)	**one**	inches	double	always
basin_snowmelt_mo	Monthly basin area-weighted average snowmelt	**one**	inches	double	always
basin_snowmelt_tot	Total simulation basin area-weighted average snowmelt	**one**	inches	double	always
basin_snowmelt_yr	Yearly basin area-weighted average snowmelt	**one**	inches	double	always
basin_tcal	Basin area-weighted average net snowpack energy balance	**one**	Langleys	double	always
frac_swe	Fraction of maximum snow-water equivalent (**snarea_thresh**) on each HRU	**nhru**	decimal fraction	real	always

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
freeh2o	Storage of free liquid water in the snowpack on each HRU	**nhru**	inches	real	always
iasw	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
int_alb	Flag to indicate (1: accumulation season curve; 2: use of the melt season curve)	**nhru**	none	integer	always
iso	Flag to indicate if time is before (1) or after (2) the day to force melt season (**melt_force**)	**nhru**	none	integer	always
lso	Counter for tracking the number of days the snowpack is at or above 0 degrees Celsius	**nhru**	number of iterations	integer	always
lst	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
It0_pkwater_equiv	Antecedent snowpack water equivalent on each HRU	**nhru**	inches	double	always
mso	Flag to indicate if time is before (1) or after (2) the first potential day for melt season (**melt_look**)	**nhru**	none	integer	always
pk_def	Heat deficit, amount of heat necessary to make the snowpack isothermal at 0 degrees Celsius	**nhru**	Langleys	real	always
pk_den	Density of the snowpack on each HRU	**nhru**	grams/cubic centimeters	real	always
pk_depth	Depth of snowpack on each HRU	**nhru**	inches	double	always
pk_ice	Storage of frozen water in the snowpack on each HRU	**nhru**	inches	real	always
pk_precip	Precipitation added to snowpack for each HRU	**nhru**	inches	real	always
pk_temp	Temperature of the snowpack on each HRU	**nhru**	**temp_units**	real	always
pksv	Snowpack water equivalent when there is new snow and in melt phase; used to interpolate between depletion curve and 100 percent on each HRU	**nhru**	inches	real	always
~~*pkwater_ante*~~	~~Antecedent snowpack water equivalent on each HRU~~	~~**nhru**~~	~~inches~~	~~double~~	~~always~~
pkwater_equiv	Snowpack water equivalent on each HRU	**nhru**	inches	double	always
pptmix_nopack	Flag indicating that a mixed precipitation event has occurred with no snowpack present on an HRU (1), otherwise (0)	**nhru**	none	integer	always
pss	Previous snowpack water equivalent plus new snow	**nhru**	inches	real	always
pst	While a snowpack exists, *pst* tracks the maximum snow water equivalent of that snowpack	**nhru**	inches	real	always
salb	Days since last new snow to reset albedo for each HRU	**nhru**	days	real	always
scrv	Snowpack water equivalent plus a portion of new snow on each HRU	**nhru**	inches	double	always

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
slst	Days since last new snow for each HRU	**nhru**	days	real	always
snow	Snow depth at each measurement station	**nsnow**	inches	real	**nsnow** > 0
snow_free	Fraction of snow-free surface for each HRU	**nhru**	decimal fraction	real	always
snowcov_area	Snow-covered area on each HRU prior to melt and sublimation unless snowpack depleted	**nhru**	decimal fraction	real	always
snowcov_areasv	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
snowmelt	Snowmelt from snowpack on each HRU (not including snow on glacier)	**nhru**	inches	real	always
snsv	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
subinc_pkweqv	Area-weighted average snowpack water equivalent from associated HRUs of each subbasin	**nsub**	inches	double	**subbasin_flag** = 1
subinc_snowcov	Area-weighted average snow-covered area from associated HRUs to each subbasin	**nsub**	decimal fraction	double	**subbasin_flag** = 1
subinc_snowmelt	Area-weighted average snowmelt from associated HRUs of each subbasin	**nsub**	inches	double	**subbasin_flag** = 1
tcal	Net snowpack energy balance on each HRU	**nhru**	Langleys	real	always
	Glacier and frozen ground computations (glacier_flag = 1)				
alt_above_ela	Altitude above equilibrium line altitude (ELA)	**nhru**	**elev_units**	real	**glacier_flag** = 1
ann_tempc	Current average year air temperature over each HRU	**nhru**	degrees Celsius	real	**glacier_flag** = 1
av_basal_slope	Glacier average basal slope at flowline location, indexed by *glacr_tag*	**nhru**	decimal fraction	real	**glacier_flag** = 1
av_fgrad	Glacier average HRU mass balance gradient with elevation at flowline at end of each hydrological year, Ngl of these	**nhru**	decimal fraction	real	**glacier_flag** = 1
basal_elev	Glacier basal elevation mean over HRU	**nhru**	**elev_units**	real	**glacier_flag** = 1
basal_slope	Glacier basal slope down flowline mean over each HRU	**nhru**	decimal fraction	real	**glacier_flag** = 1
basin_gl_area	Basin area-weighted average glacier-covered area	**one**	decimal fraction	double	**glacier_flag** = 1
basin_gl_cfs	Basin glacier surface melt (rain, snow, ice) leaving the basin through the stream network	**one**	cfs	double	**glacier_flag** = 1
basin_gl_ice_cfs	Basin glacier ice (firn) melt leaving the basin through the stream network	**one**	cfs	double	**glacier_flag** = 1
basin_gl_ice_melt	Basin area-weighted glacier ice (firn) melt coming out of termini of all glaciers and glacierettes	**one**	inches	double	**glacier_flag** = 1
basin_gl_storage	Basin area-weighted average storage change in glacier reservoirs	**one**	inches	double	**glacier_flag** = 1

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
basin_gl_storstart	Basin area-weighted average storage estimated start in glacier reservoirs	**one**	inches	double	**glacier_flag** = 1
basin_gl_storvol	Basin storage volume in glacier storage reservoirs	**one**	acre-inches	double	**glacier_flag** = 1
basin_gl_top_gain	Basin area-weighted glacier surface gain (snow and rain minus evaporation) for all glaciers and glacierettes	**one**	inches	double	**glacier_flag** = 1
basin_gl_top_melt	Basin area-weighted glacier surface melt (snow, ice and rain) coming out of termini of all glaciers and glacierettes	**one**	inches	double	**glacier_flag** = 1
basin_glacrb_melt	Basin area-weighted average basal melt of glacier, goes to soil	**one**	inches	double	**glacier_flag** = 1
basin_glacrevap	Basin area-weighted average glacier ice evaporation and sublimation	**one**	inches	double	**glacier_flag** = 1
basin_snowicecov	Basin area-weighted average snow and glacier and glacierette covered area	**one**	decimal fraction	double	**glacier_flag** = 1
cfgi	Continuous Frozen Ground Index for each HRU	**nhru**	none	integer	**frozen_flag** = 1
cfgi_prev	Continuous Frozen Ground Index from previous time step for each HRU	**nhru**	none	integer	**frozen_flag** = 1
delta_volyr	Year total volume change for each glacier, indexed by *glacr_tag* for each HRU	**nhru**	inches cubed	double	**glacier_flag** = 1
ela	HRU number at ELA corresponding to each top in each glacier (Ntp)	**nhru**	none	integer	**glacier_flag** = 1
frozen	Flag for frozen ground for each HRU (0=no; 1=yes)	**nhru**	none	integer	**frozen_flag** = 1
gl_area	Area of each glacier, indexed by *glacr_tag*	**nhru**	acres	double	**glacier_flag** = 1
gl_ice_melt	Amount of glacier ice (firn) melt coming out of terminus of glacier, indexed by *glacr_tag*	**nhru**	inches	real	**glacier_flag** = 1
gl_mb_cumul	Cumulative mass balance for each glacier since start day, indexed by *glacr_tag*	**nhru**	inches	double	**glacier_flag** = 1
gl_mb_yrcumul	Yearly mass balance for each glacier, indexed by *glacr_tag*	**nhru**	inches	real	**glacier_flag** = 1
gl_top_melt	Amount of glacier surface melt (snow, ice, rain) coming out of terminus of glacier, indexed by *glacr_tag*	**nhru**	inches	real	**glacier_flag** = 1
glacier_frac	Fraction of glaciation (0=none; 1=100%)	**nhru**	decimal fraction	real	**glacier_flag** = 1
glacr_5avsnow	Current 5-yr average snow over glacier or glacierette HRUs	**nhru**	inches/year	real	**glacier_flag** = 1
glacr_5avsnow1	First 5-yr average snow over glacier or glacierette HRUs	**nhru**	inches/year	real	**glacier_flag** = 1
glacr_air_5avtemp	Current 5-yr average summer (June July Aug) air temperature over glacier or glacierette HRUs	**nhru**	degrees Celsius	real	**glacier_flag** = 1
glacr_air_5avtemp1	First 5-yr average summer temperature over glacier or glacierette HRUs	**nhru**	degrees Celsius	real	**glacier_flag** = 1
glacr_air_deltemp	Change in 5-yr average air temperature over glacier or glacierette HRUs from first time step	**nhru**	degrees Celsius	real	**glacier_flag** = 1

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
glacr_albedo	Ice surface albedo or the fraction of radiation reflected from the icepack surface for each glacier or glacierette HRU	**nhru**	decimal fraction	real	**glacier_flag** = 1
glacr_delsnow	Change in 5-yr average snow over glacier or glacierette for each HRU from first time step	**nhru**	inches/year	real	**glacier_flag** = 1
glacr_elev_init	Glacier surface elevation mean over each HRU at initiation extrapolating to 100% glacierized HRU	**nhru**	**elev_units**	real	**glacier_flag** = 1
glacr_evap	Evaporation and sublimation from icepack on each glacier or glacierette HRU	**nhru**	inches	real	**glacier_flag** = 1
glacr_flow	Glacier melt and rain from HRU to stream network, only nonzero at termini HRUs and snowfield HRUs	**nhru**	inches cubed	real	**glacier_flag** = 1
glacr_freeh2o	Storage of free liquid water in the icepack on each glacier or glacierette HRU	**nhru**	inches	real	**glacier_flag** = 1
glacr_freeh2o_capm	Free-water holding capacity of glacier or glacierette ice, changes to 0 if active layer melts	**nhru**	decimal fraction	real	**glacier_flag** = 1
glacr_pk_def	Heat deficit, amount of heat necessary to make the glacier or glacierette snowpack isothermal at 0 degrees Celsius	**nhru**	Langleys	real	**glacier_flag** = 1
glacr_pk_den	Density of the icepack on each glacier or glacierette HRU, hard coded to equal 0.917	**nhru**	gm/cm3	real	**glacier_flag** = 1
glacr_pk_depth	Depth of icepack on each glacier or glacierette HRU, make essentially infinite	**nhru**	inches	double	**glacier_flag** = 1
glacr_pk_ice	Storage of frozen water in the icepack on each glacier or glacierette HRU	**nhru**	inches	real	**glacier_flag** = 1
glacr_pk_temp	Temperature of the glacier or glacierette on each HRU	**nhru**	degrees Celsius	real	**glacier_flag** = 1
glacr_pkwater_ante	Antecedent icepack water equivalent on each glacier or glacierette HRU	**nhru**	inches	double	**glacier_flag** = 1
glacr_pkwater_equiv	Icepack water equivalent on each glacier or glacierette HRU	**nhru**	inches	double	**glacier_flag** = 1
glacr_pss	Previous glacier or glacierette pack water equivalent plus new ice	**nhru**	inches	double	**glacier_flag** = 1
glacr_pst	While an icepack exists, *glacr_pst* tracks the maximum ice water equivalent of that icepack	**nhru**	inches	double	**glacier_flag** = 1
glacr_slope_init	Glacier surface slope mean over HRU at initiation extrapolating to 100% glacierized HRU	**nhru**	**elev_units**	real	**glacier_flag** = 1
glacr_tag	Identifies which glacier each HRU belongs to	**nhru**	none	integer	**glacier_flag** = 1
glacrb_melt	Glacier or glacierette basal melt, goes to soil	**nhru**	inches/day	real	**glacier_flag** = 1
glacrcov_area	Ice-covered area (no snowpack) on each glacier HRU or HRU with glacierette at start of step	**nhru**	decimal fraction	real	**glacier_flag** = 1
glacrmelt	Melt from icepack on each glacier or glacierette HRU, includes rain water that does not absorb	**nhru**	inches	real	**glacier_flag** = 1

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
glnet_ar_delta	Sum of area change of each glacier since start year, indexed by *glacr_tag*	**nhru**	acres	double	**glacier_flag** = 1
glrette_frac	Fraction of snow field (too small for glacier dynamics)	**nhru**	decimal fraction	real	**glacier_flag** = 1
glrette_melt	Amount of glacierette surface melt (snow, ice, rain) from an HRU	**nhru**	inches	real	**glacier_flag** = 1
hru_elev_ts	HRU elevation for timestep, which can change for glaciers; used in computations in modules: `ide_dist`, `xyz_dist`, `precip_laps`, `temp_1sta`, `temp_laps`, and `temp_dist2`	**nhru**	**elev_units**	real	**glacier_flag** = 1
hru_glres_melt	Amount of glacier surface melt (snow, ice, rain) from an HRU that goes into reservoirs	**nhru**	inches	real	**glacier_flag** = 1
hru_mb_yrcumul	Mass balance for a glacier HRU, cumulative for year	**nhru**	inches	double	**glacier_flag** = 1
hru_mb_yrend	Glacier HRU mass balance at end of previous hydrological year	**nhru**	inches	real	**glacier_flag** = 1
hru_slope_ts	HRU slope for timestep, which can change for glaciers	**nhru**	decimal fraction	real	**glacier_flag** = 1
ikeep_gl	Glacier integer variables keeping from first year	**nhru**	none	integer	**glacier_flag** = 1
keep_gl	Glacier real variables keeping from first year	**nhru**	none	integer	**glacier_flag** = 1
nhrugl	Number of at least partially glacierized HRUs at initiation	**nhru**	none	integer	**glacier_flag** = 1
ode_glacrva_coef	Estimate of **glacrva_coef** from ODE basal topography of each glacier, indexed by *glacr_tag*		m**(3-2***glacrva_exp**)	real	**glacier_flag** = 1
order_flowline	Order of flowlines that belong together as glaciers, Ntp of these	**nhru**	none	integer	**glacier_flag** = 1
prev_area	Previous year glacier-covered area above each HRU where all branches of the glacier are included	**nhru, nglres**	inches squared	real	**glacier_flag** = 1
prev_out	Antecedent outflow of the 3 reservoirs in each glacier, indexed by *glacr_tag*	**nhru**	inches cubed	real	**glacier_flag** = 1
prev_outi	Antecedent outflow of the 3 reservoirs in each glacier for only ice (firn) melt, indexed by *glacr_tag*	**nhru**	inches cubed	real	**glacier_flag** = 1
prev_vol	Previous volume of each glacier, indexed by *glacr_tag*	**nhru**	inches cubed	real	**glacier_flag** = 1
term	HRU number at terminus of each glacier, Ngl of these	**nhru**	none	integer	**glacier_flag** = 1
top	HRU number at tops of each glacier, Ntp of these	**nhru**	none	integer	**glacier_flag** = 1
top_tag	Identifies which glacier top each HRU is fed by. If = -1, then has multiple feeders	**nhru**	none	integer	**glacier_flag** = 1
yrdays5	Number of days since last 5-year mark	**nhru**	days	integer	**glacier_flag** = 1
	Evapotranspiration				
basin_actet	Basin area-weighted average actual ET	**one**	inches	double	always
basin_actet_mo	Monthly basin area-weighted average actual ET	**one**	inches	double	always
basin_actet_tot	Total simulation basin area-weighted average actual ET	**one**	inches	double	always

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
basin_actet_yr	Yearly basin area-weighted average actual ET	**one**	inches	double	always
basin_dprst_evap	Basin area-weighted average evaporation from surface depression storage	**one**	inches	double	**dprst_flag** = 1
basin_fall_frost	Basin area-weighted average fall frost	**one**	**solar date**	real	**model_mode** = FROST
basin_humidity	Basin area-weighted average humidity	**one**	percentage	double	**et_module** = potet_pm, potet_pm_sta, or potet_pt
basin_imperv_evap	Basin area-weighted average evaporation from impervious area	**one**	inches	double	always
basin_lakeevap	Basin area-weighted average lake evaporation	**one**	inches	double	**nlake** > 0
basin_intcp_evap	Basin area-weighted evaporation from the canopy	**one**	inches	double	always
basin_intcp_evap_mo	Monthly basin area-weighted average interception evaporation	**one**	inches	double	always
basin_intcp_evap_tot	Total simulation basin area-weighted average interception evaporation	**one**	inches	double	always
basin_intcp_evap_yr	Yearly basin area-weighted average interception evaporation	**one**	inches	double	always
basin_perv_et	Basin area-weighted average ET from capillary reservoirs	**one**	inches	double	always
basin_potet	Basin area-weighted average potential ET	**one**	inches	double	always
basin_potet_mo	Monthly area-weighted average potential ET	**one**	inches	double	always
basin_potet_tot	Total simulation area-weighted average potential ET	**one**	inches	double	always
basin_potet_yr	Yearly area-weighted average potential ET	**one**	inches	double	always
basin_snowevap	Basin area-weighted average evaporation and sublimation from snowpack (not including glacier)	**one**	inches	double	always
basin_spring_frost	Basin area-weighted average spring frost	**one**	**solar date**	real	**model_mode** = FROST
basin_swale_et	Basin area-weighted average ET from swale HRUs	**one**	inches	double	always
basin_transp_on	Flag indicating whether transpiration is occurring anywhere in the basin (0=no; 1=yes)	**one**	none	integer	always
basin_windspeed	Basin area-weighted average wind speed	**one**	meters per second	double	**et_module** = potet_pm or potet_pm_sta
dprst_evap_hru	Evaporation from surface-depression storage for each HRU	**nhru**	inches	real	**dprst_flag** = 1
fall_frost	The solar date (number of days after winter solstice) of the first killing frost of the fall	**nhru**	**solar date**	real	**model_mode** = FROST
hru_actet	Actual ET for each HRU	**nhru**	inches	real	always
hru_et_yr	Yearly area-weighted average actual ET for each HRU	**nhru**	inches	double	**print_freq** = 2
hru_intcpevap	Evaporation from the canopy for each HRU	**nhru**	inches	real	always
hru_perv_actet	Actual ET from the capillary reservoir as HRU value	**nhru**	inches	real	always
imperv_evap	Evaporation from impervious area for each HRU	**nhru**	inches	real	always
intcp_evap	Evaporation from the canopy for each HRU	**nhru**	inches	real	always

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
lake_evap	Total evaporation from each lake HRU	**nlake**	cfs	double	**nlake** > 0
pan_evap	Pan evaporation at each measurement station	**nevap**	inches	real	**nevap** > 0
perv_actet	Actual ET from the capillary reservoir of each HRU	**nhru**	inches	real	always
potet	Potential ET for each HRU	**nhru**	inches	real	always
potet_lower	Potential ET in the lower zone of the capillary reservoir for each HRU	**nhru**	inches	real	always
potet_rechr	Potential ET in the recharge zone of the capillary reservoir for each HRU	**nhru**	inches	real	always
seginc_potet[6]	Area-weighted average potential ET for each segment from HRUs contributing flow to the segment	**nsegment**	inches	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
snow_evap	Evaporation and sublimation from snowpack on each HRU	**nhru**	inches	real	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

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
	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_waterin	Infiltration and any cascading interflow and Dunnian surface runoff added to capillary reservoir storage for each HRU	**nhru**	inches	real	always
basin_contrib_fraction	Basin area-weighted average contributing area of the pervious area of each HRU	**one**	decimal fraction	double	always
basin_hortonian	Basin area-weighted average Hortonian runoff	**one**	inches	double	always
basin_hortonian_lakes	Basin area-weighted average Hortonian surface runoff to lakes	**one**	inches	double	**cascade_flag** = 1 and **ncascade** > 0
basin_imperv_stor	Basin area-weighted average storage on impervious area	**one**	inches	double	always
basin_infil	Basin area-weighted average infiltration to the capillary reservoirs	**one**	inches	double	always
basin_sroff	Basin area-weighted average surface runoff to the stream network	**one**	inches	double	always
basin_sroff_cfs	Basin area-weighted average surface runoff to the stream network	**one**	cfs	double	always
basin_sroff_down	Basin area-weighted average cascading surface runoff	**one**	inches	double	**cascade_flag** = 1 and **ncascade** > 0
basin_sroff_mo	Monthly basin area-weighted average surface runoff	**one**	inches	double	always
basin_sroff_tot	Total simulation basin area-weighted average surface runoff	**one**	inches	double	always
basin_sroff_upslope	Basin area-weighted average cascading surface runoff received from upslope HRUs	**one**	inches	double	**cascade_flag** = 1 and **ncascade** > 0
basin_sroff_yr	Yearly basin area-weighted average surface runoff	**one**	inches	double	always
basin_sroffi	Basin area-weighted average surface runoff from impervious areas	**one**	inches	double	always
basin_sroffp	Basin area-weighted average surface runoff from pervious areas	**one**	inches	double	always
contrib_fraction	Contributing area of each HRU pervious area	**nhru**	decimal fraction	real	always
hortonian_flow	Hortonian surface runoff reaching stream network for each HRU	**nhru**	inches	real	always
hortonian_lakes	Surface runoff to lakes for each HRU	**nhru**	inches	double	**cascade_flag** = 1, **ncascade** > 0, and **nlake** > 0
hru_frac_dprst	Fraction of each HRU area that is surface-depression storage	**nhru**	decimal fraction	real	always
hru_frac_imperv	Fraction of HRU that is impervious	**nhru**	decimal fraction	real	always
hru_frac_perv	Fraction of HRU that is pervious	**nhru**	decimal fraction	real	always
hru_hortn_cascflow	Cascading Hortonian surface runoff leaving each HRU	**nhru**	inches	double	**cascade_flag** = 1 and

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
					ncascade > 0
hru_imperv	Area of HRU that is impervious	**nhru**	acres	real	always
hru_impervstor	Storage on impervious area for each HRU	**nhru**	inches	real	always
hru_perv	Area of HRU that is pervious	**nhru**	acres	real	always
hru_sroffi	HRU area-weighted average surface runoff from impervious areas flowing out of each HRU	**nhru**	inches	real	always
hru_sroffp	HRU area-weighted average surface runoff from pervious areas flowing out of each HRU	**nhru**	inches	real	always
imperv_stor	Storage on impervious area for each HRU	**nhru**	inches	real	always
infil	Infiltration to the capillary reservoir for each HRU	**nhru**	inches	real	always
seginc_sroff[6]	Area-weighted average surface runoff for each segment from HRUs contributing flow to the segment	**nsegment**	cfs	double	**nsegment** > 0
sroff[3]	Surface runoff to the stream network for each HRU	**nhru**	inches	real	always
sub_sroff	Area-weighted average Hortonian plus Dunnian surface runoff from associated HRUs to each subbasin and from upstream subbasins	**nsub**	cfs	double	**subbasin_flag** = 1
subinc_sroff	Area-weighted average Hortonian plus Dunnian surface runoff from associated HRUs to each subbasin	**nsub**	cfs	double	**subbasin_flag** = 1
upslope_hortonian	Hortonian surface runoff received from upslope HRUs	**nhru**	inches	double	**cascade_flag** = 1 and **ncascade** > 0
	Surface depression storage (dprst_flag = 1)				
basin_dprst_seep	Basin area-weighted average seepage surface-depression storage	**one**	inches	double	**dprst_flag** = 1
basin_dprst_sroff	Basin area-weighted average surface runoff from open surface-depression storage	**one**	inches	double	**dprst_flag** = 1
basin_dprst_volcl	Basin area-weighted average storage volume in closed surface depressions	**one**	inches	double	**dprst_flag** = 1
basin_dprst_volop	Basin area-weighted average storage volume in open surface depressions	**one**	inches	double	**dprst_flag** = 1
dprst_area_clos	Surface area of closed surface depressions based on volume for each HRU	**nhru**	acres	real	**dprst_flag** = 1
dprst_area_clos_max	Aggregate sum of closed surface-depression storage areas of each HRU	**nhru**	acres	real	**dprst_flag** = 1
dprst_area_max	Aggregate sum of surface-depression storage areas of each HRU	**nhru**	acres	real	**dprst_flag** = 1
dprst_area_open	Surface area of open surface depressions based on volume for each HRU	**nhru**	acres	real	**dprst_flag** = 1

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
dprst_area_open_max	Aggregate sum of open surface-depression storage areas of each HRU	**nhru**	acres	real	**dprst_flag** = 1
dprst_insroff_hru	Surface runoff from pervious and impervious portions into surface depression storage for each HRU	**nhru**	inches	real	**dprst_flag** = 1
dprst_seep_hru	Seepage from surface-depression storage to associated GWR for each HRU	**nhru**	inches	double	**dprst_flag** = 1
dprst_sroff_hru	Surface runoff from open surface-depression storage for each HRU	**nhru**	inches	double	**dprst_flag** = 1
dprst_stor_hru	Surface-depression storage for each HRU	**nhru**	inches	double	**dprst_flag** = 1
dprst_vol_clos	Storage volume in closed surface depressions for each HRU	**nhru**	acre-inches	double	**dprst_flag** = 1
dprst_vol_clos_frac	Fraction of closed surface-depression storage of the maximum storage for each HRU	**nhru**	decimal fraction	real	**dprst_flag** = 1
dprst_vol_frac	Fraction of surface-depression storage of the maximum storage for each HRU	**nhru**	decimal fraction	real	**dprst_flag** = 1
dprst_vol_open	Storage volume in open surface depressions for each HRU	**nhru**	acre-inches	double	**dprst_flag** = 1
dprst_vol_open_frac	Fraction of open surface-depression storage of the maximum storage for each HRU	**nhru**	decimal fraction	real	**dprst_flag** = 1
	Soil zone storage, interflow, gravity drainage, Dunnian surface runoff				
basin_cap_infil_tot	Basin area-weighted average infiltration with cascading flow into capillary reservoirs	**one**	inches	double	always
~~*basin_cap_up_max*~~	~~Basin area-weighted average maximum cascade flow that flows to capillary reservoirs~~	~~**one**~~	~~inches~~	~~double~~	~~**cascade_flag** = 1 and **ncascade** > 0~~
basin_capwaterin	Basin area-weighted average infiltration and any cascading interflow and Dunnian flow added to capillary reservoir storage	**one**	inches	double	always
basin_cpr_stor_frac	Basin area-weighted average fraction of capillary reservoir storage of the maximum storage	**one**	decimal fraction	double	always
basin_dncascadeflow	Basin area-weighted average cascading interflow and Dunnian surface runoff	**one**	inches	double	**cascade_flag** = 1 and **ncascade** > 0
basin_dndunnianflow	Basin area-weighted average cascading Dunnian flow	**one**	inches	double	**cascade_flag** = 1 and **ncascade** > 0
basin_dninterflow	Basin area-weighted average cascading interflow	**one**	inches	double	**cascade_flag** = 1 and **ncascade** > 0
basin_dunnian	Basin area-weighted average Dunnian surface runoff that flows to the stream network	**one**	inches	double	always
basin_dunnian_gvr	Basin area-weighted average excess flow to preferential-flow reservoirs from gravity reservoirs	**one**	inches	double	always
basin_dunnian_pfr	Basin area-weighted average excess infiltration to preferential-	**one**	inches	double	always

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
	flow reservoirs from variable *infil*				
basin_dunnianflow	Basin area-weighted average cascading Dunnian flow	**one**	inches	double	always
basin_gvr2pfr	Basin area-weighted average excess flow to preferential-flow reservoir storage from gravity reservoirs	**one**	inches	double	always
~~*basin_gvr_stor_frac*~~	~~Basin area-weighted average fraction of gravity reservoir storage of the maximum storage~~	~~**one**~~	~~decimal fraction~~	~~double~~	~~always~~
basin_interflow_max	Basin area-weighted average maximum interflow that flows from gravity reservoirs	**one**	inches	double	always
basin_lakeinsz	Basin area-weighted average lake inflow from land HRUs	**one**	inches	double	**cascade_flag** = `1`, **ncascade** > `0`, and **nlake** > `0`
basin_pfr_stor_frac	Basin area-weighted average fraction of preferential-flow reservoir storage of the maximum storage	**one**	decimal fraction	double	always
basin_pref_flow_infil	Basin area-weighted average infiltration to preferential-flow reservoir storage	**one**	inches	double	always
basin_pref_stor	Basin area-weighted average storage in preferential-flow reservoirs	**one**	inches	double	always
basin_prefflow	Basin area-weighted average interflow from preferential-flow reservoirs to the stream network	**one**	inches	double	always
basin_recharge	Basin area-weighted average recharge to GWRs	**one**	inches	double	always
basin_slowflow	Basin area-weighted average interflow from gravity reservoirs to the stream network	**one**	inches	double	always
basin_slstor	Basin area-weighted average storage of gravity reservoirs	**one**	inches	double	always
basin_sm2gvr	Basin area-weighted average excess flow from capillary reservoirs to gravity reservoir storage	**one**	inches	double	always
basin_sm2gvr_maxin	Basin area-weighted average maximum excess flow from capillary reservoirs that flows to gravity reservoirs	**one**	inches	double	always
basin_soil_lower_stor_frac	Basin area-weighted average fraction of soil lower zone storage of the maximum storage	**one**	decimal fraction	double	always
basin_soil_moist	Basin area-weighted average capillary reservoir storage	**one**	inches	double	always
basin_soil_moist_tot	Basin area-weighted average total soil-zone water storage	**one**	inches	double	always
basin_soil_rechr	Basin area-weighted average storage for recharge zone; upper portion of capillary reservoir where both evaporation and transpiration occurs	**one**	inches	double	always
basin_soil_rechr_stor_frac	Basin area-weighted average fraction of soil recharge zone storage of the maximum storage	**one**	decimal fraction	double	always
basin_soil_to_gw	Basin area-weighted average excess flow to capillary reservoirs that drains to GWRs	**one**	inches	double	always

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
basin_ssflow	Basin area-weighted average interflow from gravity and preferential-flow reservoirs to the stream network	**one**	inches	double	always
basin_ssflow_cfs	Basin area-weighted average interflow from gravity and preferential-flow reservoirs to the stream network	**one**	cfs	double	always
basin_ssflow_mo	Monthly basin area-weighted average interflow	**one**	inches	double	always
basin_ssflow_tot	Simulation total basin area-weighted average interflow	**one**	inches	double	always
basin_ssflow_yr	Yearly basin area-weighted average interflow	**one**	inches	double	always
basin_ssin	Basin area-weighted average inflow to gravity and preferential-flow reservoir storage	**one**	inches	double	always
basin_ssstor	Basin area-weighted average gravity and preferential-flow reservoir storage	**one**	inches	double	always
basin_sz2gw	Basin area-weighted average drainage from gravity reservoirs to GWRs	**one**	inches	double	always
basin_sz_stor_frac	Basin area-weighted average fraction of soil zone storage of the maximum storage	**one**	decimal fraction	double	always
cap_infil_tot	Infiltration and cascading interflow and Dunnian flow 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
dunnian_flow	Dunnian surface runoff that flows to the stream network for each HRU	**nhru**	inches	real	always
hru_dunnian_cascadeflow	Cascading Dunnian surface runoff from each HRU	**nhru**	inches	double	**cascade_flag** = 1 and **ncascade** > 0
hru_interflow_cascadeflow	Cascading interflow from each HRU	**nhru**	inches	double	**cascade_flag** = 1 and **ncascade** > 0
hru_sz_cascadeflow	Cascading interflow and Dunnian surface runoff from each HRU	**nhru**	inches	double	**cascade_flag** = 1 and **ncascade** > 0
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	**nhru**	inches	real	always

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
	and maximum soil saturation minus the any' preferential-flow storage				
recharge	Recharge to the associated GWR as the sum of *soil_to_gw*, *ssr_to_gw*, and *dprst_seep_hru* for each HRU	**nhru**	inches	real	always
seginc_ssflow[6]	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 ratio 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_tot	Total soil-zone storage (*soil_moist* + *ssres_stor*) 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_saturated	Flag set if infiltration saturates capillary reservoir (0=no, 1=yes)	**nhru**	none	integer	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
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	**nsub**	inches	double	**subbasin_flag** = 1

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
	subbasin				
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
gwres_flow	Groundwater discharge from each GWR to the stream network	**ngw**	inches	real	always
gwres_in	Total inflow to each GWR from associated capillary and gravity reservoirs	**ngw**	acre-inches	double	always
gwres_sink	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
gwres_stor	Storage in each GWR	**ngw**	inches	double	always
gwstor_minarea_wb	Storage added to each GWR when storage is less than **gwstor_min**	**ngw**	inches	double	always
hru_gw_cascadeflow	Cascading groundwater flow from each GWR	**ngw**	inches	double	**cascadegw_flag** = 1 and **ncascdgw** > 0
lakein_gwflow	Groundwater flow received from upslope GWRs for each Lake GWR	**nlake**	acre-inches	double	**nlake** > 0

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
seginc_gwflow[6]	Area-weighted average groundwater discharge for each segment from HRUs contributing flow to the segment	**nsegment**	cfs	double	**nsegment** > 0
sub_gwflow	Area-weighted average groundwater discharge from associated GWRs to each subbasin and from upstream subbasins	**nsub**	cfs	double	**subbasin_flag** = 1
subinc_gwflow	Area-weighted average groundwater discharge from associated GWRs to each subbasin	**nsub**	cfs	double	**subbasin_flag** = 1
		Streamflow			
basin_cfs	Streamflow leaving the basin through the stream network	**one**	cfs	double	always
basin_cfs_mo	Monthly total streamflow to stream network	**one**	cfs	double	**print_debug** > -2
basin_cfs_tot	Total simulation basin area-weighted average streamflow	**one**	cfs	double	**print_debug** > -2
basin_cfs_yr	Yearly total streamflow to stream network	**one**	cfs	double	**print_debug** > -2
basin_cms	Streamflow leaving the basin through the stream network	**one**	cms	double	always
basin_runoff_ratio	Basin area-weighted average discharge/precipitation ratio	**one**	decimal fraction	double	**print_debug** > -2
basin_runoff_ratio_mo	Monthly area-weighted average discharge/precipitation ratio	**one**	decimal fraction	double	**print_debug** > -2
basin_segment_storage	Basin area-weighted average storage in the stream network	**one**	inches	double	**strmflow_module** = muskingum, muskingum_lake, or muskingum_mann
basin_stflow_in	Basin area-weighted average lateral flow entering the stream network	**one**	inches	double	always
basin_stflow_mo	Monthly basin area-weighted average simulated streamflow	**one**	inches	double	**print_debug** > -2
basin_stflow_out	Basin area-weighted average streamflow leaving through the stream network	**one**	inches	double	**print_debug** > -2
basin_stflow_tot	Total simulation basin area-weighted average simulated streamflow	**one**	inches	double	**print_debug** > -2
basin_stflow_yr	Yearly basin area-weighted average simulated streamflow	**one**	inches	double	**print_debug** > -2
flow_headwater	Total flow out of headwater segments (**segment_type**=1)	**one**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
flow_in_great_lakes	Total flow into model domain from Great Lakes (**segment_type**=10)	**one**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
flow_in_nation	Total flow into model domain from Mexico or Canada	**one**	cfs	double	**strmflow_module** =

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
	(**segment_type**=4)				muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
flow_in_region	Total flow into region (**segment_type**=6)	**one**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
flow_out	Total flow out of model domain	**one**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
flow_out_NHM	Total flow out of model domain to Mexico or Canada (**segment_type**=5)	**one**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
flow_out_region	Total flow out of region (**segment_type**=7)	**one**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
flow_replacement	Total flow out from replacement flow (**segment_type**=3)	**one**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
flow_terminus	Total flow to terminus segments (**segment_type**=9)	**one**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
flow_to_great_lakes	Total flow to Great Lakes (**segment_type**=11)	**one**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out,

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
					muskingum_lake, or muskingum_mann
flow_to_lakes	Total flow to lakes (**segment_type**=2)	**one**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
flow_to_ocean	Total flow to oceans (**segment_type**=8)	**one**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
hru_outflow	Total flow leaving each HRU	**nhru**	cfs	double	always
hru_streamflow_out	Total flow to stream network from each HRU	**nhru**	cfs	double	always
obs_runoff_mo	Monthly measured streamflow at basin outlet	**one**	cfs	double	**print_debug** > -2
obs_runoff_tot	Total simulation measured streamflow at basin outlet	**one**	cfs	double	**print_debug** > -2
obs_runoff_yr	Yearly measured streamflow at basin outlet	**one**	cfs	double	**print_debug** > -2
obsq_inches	Measured streamflow at specified outlet station	**one**	inches	double	**print_debug** > -2
obsq_inches_mo	Monthly measured streamflow at specified outlet station	**one**	inches	double	**print_debug** > -2
obsq_inches_tot	Total simulation basin area-weighted average measured streamflow at specified outlet station	**one**	inches	double	**print_debug** > -2
obsq_inches_yr	Yearly measured streamflow at specified outlet station	**one**	inches	double	**print_debug** > -2
runoff	Streamflow at each measurement station	**nobs**	**runoff_units**	real	**nobs** > 0
seg_gwflow[6]	Area-weighted average groundwater flow for each segment from HRUs contributing flow to the segment	**nsegment**	inches	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
seg_inflow	Total flow entering a segment	**nsegment**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
seg_lateral_inflow	Lateral inflow entering a segment	**nsegment**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
					muskingum_mann
seg_outflow	Streamflow leaving a segment	**nsegment**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
seg_sroff[6]	Area-weighted average surface runoff for each segment from HRUs contributing flow to the segment	**nsegment**	inches	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
seg_ssflow[6]	Area-weighted average interflow for each segment from HRUs contributing flow to the segment	**nsegment**	inches	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
seg_upstream_inflow	Sum of inflow from upstream segments	**nsegment**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
seg_upstream_gwflow	Area-weighted average groundwater flow for each segment from upstream HRUs	**nsegment**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
seg_upstream_sroff	Area-weighted average surface runoff for each segment from upstream HRUs	**nsegment**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
seg_upstream_ssflow	Area-weighted average interflow for each segment from upstream HRUs	**nsegment**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
segcum_gwflow	Area-weighted average groundwater flow for each segment	**nsegment**	cfs	double	**strmflow_module** =

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
	from HRUs contributing flow to the segment including upstream HRUs				muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
segcum_sroff	Area-weighted average surface runoff for each segment from HRUs contributing flow to the segment including upstream HRUs	**nsegment**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
segcum_ssflow	Area-weighted average interflow for each segment from HRUs contributing flow to the segment including upstream HRUs	**nsegment**	cfs	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
segmentcum_hruarea	Contributing area to each segment including upslope HRUs	**nsegment**	acres	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
segment_delta_flow	Cumulative flow minus flow out for each stream segment	**nsegment**	cfs	double	**strmflow_module** = muskingum, muskingum_lake, or muskingum_mann
segment_hruarea	Contributing area to each segment	**nsegment**	acres	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
segment_upstream_hruarea	Contributing area to each segment from upslope HRUs	**nsegment**	acres	double	**strmflow_module** = muskingum, strmflow_in_out, muskingum_lake, or muskingum_mann
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_in[3]	Flow in stream segments as a result of cascading flow in each stream segment	**nsegment**	cfs	double	**cascade_flag** = 1 and **ncascade** > 0

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
sub_cfs	Total streamflow leaving each subbasin	**nsub**	cfs	double	**subbasin_flag** = 1
sub_cms	Total streamflow leaving each subbasin	**nsub**	cms	double	**subbasin_flag** = 1
sub_inq	Sum of streamflow from upstream subbasins to each subbasin	**nsub**	cfs	double	**subbasin_flag** = 1
		Stream Temperature			
seg_area	Cross sectional area of flow in each segment	**nsegment**	square meters	real	**stream_temp_flag** = 1
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
seg_depth	Depth of flow in each segment	**nsegment**	meters	real	**stream_temp_flag** = 1
seg_humid	Area-weighted average relative humidity for each segment from HRUs contributing flow to the segment	**nsegment**	decimal fraction	real	**stream_temp_flag** = 1
seg_melt	Area-weighted average snowmelt for each segment from HRUs contributing flow to the segment	**nsegment**	inches	real	**stream_temp_flag** = 1
seg_potet	Area-weighted average rainfall for each segment from HRUs contributing flow to the segment	**nsegment**	inches	real	**stream_temp_flag** = 1
seg_res_time	Mean residence time of water in each segment	**nsegment**	seconds	real	**stream_temp_flag** = 1
seg_shade	Area-weighted average shade fraction for each segment	**nsegment**	seconds	real	**stream_temp_flag** = 1
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_ss	Subsurface temperature	**nsegment**	degrees Celsius	real	**stream_temp_flag** = 1
seg_tave_upstream	Temperature of streamflow entering each segment	**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_velocity	Mean velocity of flow in each segment	**nsegment**	meters per second	real	**stream_temp_flag** = 1
seg_width	Width of flow in each segment	**nsegment**	meters	real	**stream_temp_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`
basin_lake_seep	Basin area-weighted average lake-bed seepage to GWRs	**one**	acre-feet	double	**strmflow_module** = `muskingum_lake`
basin_lake_stor	Basin volume-weighted average storage for all lakes using broad-crested weir or gate opening routing	**one**	inches	double	**strmflow_module** = `muskingum_lake`
din1	Inflow to each lake HRU using Puls or linear storage routing	**nlake**	cfs	double	**strmflow_module** = `muskingum_lake`
elevlake	Surface elevation of each lake	**nlake**	feet	real	**strmflow_module** =

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
					`muskingum_lake` and **nratetbl** > `0`
gate_ht	Height of the gate opening at each dam with a gate	**nratetbl**	inches	real	**strmflow_module** = `muskingum_lake` and **nratetbl** > `0`
gw_seep_lakein	Groundwater discharge to each lake HRU for each GWR	**ngw**	acre-feet	double	**strmflow_module** = `muskingum_lake`
lakein_sz	Cascading interflow and Dunnian surface runoff to lake HRUs from each upslope HRU	**nhru**	inches	double	**cascade_flag** = `1`, **ncascade** > `0`, and **nlake >** `0`
lake_2gw	Total seepage from each lake using broad-crested weir or gate opening routing	**nlake**	cfs	double	**strmflow_module** = `muskingum_lake`
lake_elev	Elevation of each simulated lake surface	**nlakeelev**	feet	real	**strmflow_module** = `muskingum_lake` and **nlakeelev** > `0`
lake_gwflow	Total groundwater flow into each lake	**nlake**	cfs	double	**strmflow_module** = `muskingum_lake`
lake_inflow	Total inflow to each lake	**nlake**	cfs	double	**strmflow_module** = `muskingum_lake`
lake_interflow	Total interflow into each lake	**nlake**	cfs	double	**strmflow_module** = `muskingum_lake`
lake_invol	Inflow to each lake using broad-crested weir or gate opening routing	**nlake**	acre-feet	double	**strmflow_module** = `muskingum_lake`
lake_lateral_inflow	Lateral inflow to each lake	**nlake**	cfs	double	**strmflow_module** = `muskingum_lake`
lake_outcfs	Streamflow leaving each lake, includes any second outlet flow	**nlake**	cfs	double	**strmflow_module** = `muskingum_lake`
lake_outcms	Streamflow leaving each lake, includes any second outlet flow	**nlake**	cms	double	**strmflow_module** = `muskingum_lake`
lake_outflow	Evaporation and seepage from each lake	**nlake**	cfs	double	**strmflow_module** = `muskingum_lake`
lake_outq2	Streamflow from second outlet for each lake with a second outlet	**nlake**	cfs	double	**strmflow_module** = `muskingum_lake`
lake_outvol	Outflow from each lake using broad-crested weir or gate opening routing	**nlake**	acre-feet	double	**strmflow_module** = `muskingum_lake`
lake_outvol_ts	Outflow from each lake using broad-crested weir or gate opening routing for the time step	**nlake**	acre-inches	double	**strmflow_module** = `muskingum_lake`
lake_seep_in	Total seepage into each lake using broad-crested weir or gate opening routing	**nlake**	cfs	double	**strmflow_module** = `muskingum_lake`

Variable name	Description	Dimension[1]	Units	Data type	Availability/condition
lake_seepage	Lake-bed seepage from each lake to the associated GWR	**ngw**	acre-feet	double	**strmflow_module** = `muskingum_lake`
lake_seepage_gwr	Net lake-bed seepage to associated GWR	**ngw**	inches	double	**strmflow_module** = `muskingum_lake`
lake_sroff	Total surface runoff into each lake	**nlake**	cfs	double	**cascade_flag** = 1
lake_sto	Storage in each lake using Puls or linear storage routing	**nlake**	cfs-days	double	**strmflow_module** = `muskingum_lake`
lake_stream_in	Total streamflow to each lake	**nlake**	cfs	double	**strmflow_module** = `muskingum_lake`
lake_vol	Storage in each lake using broad-crested weir or gate opening routing	**nlake**	acre-feet	double	**strmflow_module** = `muskingum_lake`
		Water balance			
basin_capillary_wb	Basin area-weighted average capillary reservoir storage	**one**	inches	double	**print_debug** = 1
basin_dprst_wb	Basin area-weighted average surface-depression storage	**one**	inches	double	**print_debug** = 1
basin_gravity_wb	Basin area-weighted average gravity reservoir storage	**one**	inches	double	**print_debug** = 1
basin_soilzone_wb	Basin area-weighted average storage in soilzone reservoirs	**one**	inches	double	**print_debug** = 1
basin_storage	Basin area-weighted average storage in all water-storage reservoirs	**one**	inches	double	always
basin_storvol	Basin area-weighted average storage volume in all water-storage reservoirs	**one**	acre-inches	double	always
basin_surface_storage	Basin area-weighted average storage in all water storage reservoirs	**one**	inches	double	**csvON_OFF** = 1
basin_total_storage	Basin area-weighted average storage in all water storage reservoirs	**one**	inches	double	**csvON_OFF** = 1
hru_lateral_flow	Lateral flow to stream network from each HRU	**nhru**	inches	double	always
hru_storage	Storage for each HRU	**nhru**	inches	double	always
last_basin_stor	Basin area-weighted average storage in all water storage reservoirs from previous time step	**one**	inches	double	**print_debug** = 1
subinc_deltastor	Change in storage for each subbasin	**nsub**	inches	double	**subbasin_flag** = 1
subinc_stor	Area-weighted average total water content in storage reservoirs for associated HRUs of each subbasin	**nsub**	inches	double	**subbasin_flag** = 1
subinc_wb	Water balance for each subbasin	**nsub**	inches	double	**subbasin_flag** = 1
watbal_sum	Water balance aggregate	**one**	inches	double	always

[1]Dimension variables defined in table 1-1.

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

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

[4]Reflects availability of variables based on module selections. See variable description for the reason(s) a variable is conditional or always available.
[5]Values are set to the last valid computed value; value is < -99.0 or > 150.
[6]not available when cascades are specified

Table CBH (NEW). Time-series input variables that can be specified in Climate-by-HRU Files for the Precipitation-Runoff Modeling System (Updated for PRMS 5.2.1)

[ET, evapotranspiration; **precip_units**, 0=inches; 1=millimeters; **temp_units**, 0=degrees Fahrenheit; 1=degrees Celsius; >=, greater than or equal to; red text indicates new for PRMS-5.2.1]

Variable	Definition	Units	Valid range	Dimension[1]	Used in Modules
albedo_hru	Snowpack albedo of each HRU read from CBH File	decimal fraction	0.0 to 1.0	**nhru**	snowcomp
cloud_cover_cbh	Cloud_cover of each HRU read from CBH File	decimal fraction	0.0 to 1.0	**nhru**	ccsolrad
hru_ppt	Precipitation distributed to each HRU	**precip_units**	>=0.0	**nhru**	precipitation distribution process
humidity_hru	Relative humidity of each HRU read from CBH File	percentage	0.0 to 100.0	**nhru**	potet_pm, potet_pt, and stream_temp
potet	Potential ET for each HRU	inches	>=0.0	**nhru**	potential evapotranspiration process
swrad	Shortwave radiation distributed to each HRU	Langleys	>=0.0	**nhru**	solar radiation process
tmax_hru[2]	Maximum air temperature distributed to each HRU	**temp_units**	-150.0 to 200.0	**nhru**	temperature distribution process
tmin_hru[3]	Minimum air temperature distributed to each HRU	**temp_units**	-150.0 to 200.0	**nhru**	temperature distribution process
transp_on	Flag indicating whether transpiration is occurring (0=no; 1=yes)	none	0 or 1	**nhru**	transpiration period process
windspeed_hru	Wind speed for each HRU read from CBH File	meters per second	>=0.0	**nhru**	potet_pm

[1]Dimensions defined in table 1-1.

[2]Values used to set *tmaxf and tmaxc* after adding **tmax_cbh_adj**.

[3]Values used to set *tminf and tminc* after adding **tmin_cbh_adj**.

References

Primary PRMS-IV documentation:

Markstrom, S.L., Regan, R.S., Hay, L.E., Viger, R.J., Webb, R.M.T., Payn, R.A., and LaFontaine, J.H., 2015, PRMS-IV, the precipitation-runoff modeling system, version 4: U.S. Geological Survey Techniques and Methods, book 6, chap. B7, 158 p. https://dx.doi.org/10.3133/tm6B7. File **tm6b7_PRMS-IV.pdf** in the ‘doc’ subdirectory.

PRM 6.0.0 software release:

Regan, R.S., Markstrom, S.L., LaFontaine, J.H., and Norton, P.A., 2025, The precipitation-runoff modeling system, software release version 6.0.0, with release notes from version 4.0.1 March 11, 2015 to version 6.0.0 January 22, 2025: U.S. Geological Survey Software Release, https://doi.org/20.5066/P97032NH.