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

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

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

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

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

**Table 1-1.** Dimensions used in the Precipitation-Runoff Modeling System, version 4 (PRMS-IV).
[HRU, hydrologic response unit; GWR, groundwater reservoir; >, greater than; control parameters **temp_module**, **precip_module**, **solrad_module**, **et_module**, **strmflow_module**, **subbasin_flag**, **cascade_flag**, **cascadegw_flag**, **model_mode** and **mapOutON_OFF** defined in table 1-2; parameter **hru_solsta** defined in table 1-3]

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

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

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

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

| Parameter name[4] | Description | Option | Number of Values | Data type | Default value |
|---|---|---|---|---|---|
| | Simulation execution and required input and output files | | | | |
| **csv_output_file** | Pathname for GSFLOW Comma-Separated-Values (CSV) File of GSFLOW water budget and mass balance results for each time step | **model_mode** = GSFLOW | 1 | 4 | gsflow.csv |
| **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 |
| **gsf_rpt** | Switch to specify whether or not the GSFLOW Comma-Separated-Values (CSV) File is generated (0=no; 1=yes) | **model_mode** = GSFLOW | 1 | 1 | 1 |
| **gsflow_output_file** | Pathname for MODFLOW Name File | **model_mode** = GSFLOW or MODFLOW | 1 | 4 | modflow.nam |
| **model_mode** | Flag to indicate the simulation mode (PRMS=PRMS; FROST=growing season for each HRU; WRITE_CLIMATE=write CBH files of minimum and maximum air temperature (variables *tminf* and *tmaxf*-Fahrenheit); precipitation (variable *hru_ppt*-inches); solar radiation (variable *swrad*-Langleys); potential ET (variable *potet*-inches); and/or transpiration flag (variable *transp_on*-none); DOCUMENTATION=write files of all declared parameters and variables in the executable) | simulation mode selection | 1 | 4 | PRMS |
| **model_output_file**[2] | Pathname for Water-Budget File for results module basin_sum | simulation output | 1 | 4 | prms.out |
| **modflow_name** | Pathname for GSFLOW Comma-Separated-Values (CSV) File of GSFLOW water budget and mass balance results for each time step | **model_mode** = GSFLOW | 1 | 4 | gsflow.csv |
| **modflow_time_zero**[2] | Date and time for the first MODFLOW initial stress period in the control item as: year, month, day, hour, minute, second | **model_mode** = GSFLOW or MODFLOW and **init_vars_from_file** = 1 or **save_vars_to_file** = 1 | 6 | 1 | **start_time** |
| **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 Basin, **nsub**, or | **basinOutON_OFF** = 1, or | 1 | 1 | 1 |

| Parameter name[4] | Description | Option | Number of Values | Data type | Default value |
|---|---|---|---|---|---|
| | **nsegment** Summary Output Files | **nsegmentOutON_OFF** or **nsubOutON_OFF** = 1 | | | |
| **rpt_days** | Frequency that summary tables are written to the GSFLOW Water-Budget File (`0`=none; >`0`=frequency in days, e.g., 1 = daily, `7`=every 7th day) | **model_mode** = GSFLOW | 1 | 1 | `7` |
| **start_time** | Simulation start date and time specified in order in the control item as: year, month, day, hour, minute, second | time period | 6 | 1 | `2000`, `10`, `1`, `0`, `0`, `0` |
| | Module selection and simulation options | | | | |
| **cascade_flag** | Flag to indicate if HRU cascades are computed (`0`=no; `1`=yes) | cascade flow with **ncascade** > `0` | 1 | 1 | `1` |
| **cascadegw_flag** | Flag to indicate if GWR cascades are computed (`0`=no; `1`=yes; 2 = GWR cascades are set equal to the HRU cascades and parameters **gw_up_id**, **gw_strmseg_down_in**, **gw_down_id**, and **gw_pct_up** are not required) | cascade flow with **ncascdgw** > `0` | 1 | 1 | `1` |
| **dprst_flag** | Flag to indicate if depression-storage simulation is computed (`0`=no; `1`=yes) | surface-depression storage | 1 | 1 | `0` |
| **et_module** | Module name for potential evapotranspiration method (`climate_hru`, `potet_jh`, `potet_hamon`, `potet_hs`, `potet_pt`, `potet_pm`, `potet_pm_sta`, or `potet_pan`) | module selection | 1 | 4 | `potet_jh` |
| **gwr_swale_flag** | Flag to indicate if GWR swales are allowed (`0`=no; `1`=groundwater flow goes to groundwater sink; `3`=groundwater flow goes to stream segment specified using parameter **hru_segment**) | swales | 1 | 1 | `0` |
| **precip_module** | Module name for precipitation-distribution method (`climate_hru`, `ide_dist`, `precip_1sta`, `precip_dist2`, `precip_laps`, or `xyz_dist`) | module selection | 1 | 4 | `precip_1sta` |
| **solrad_module** | Module name for solar-radiation-distribution method (`ccsolrad` or `ddsolrad`) | module selection | 1 | 4 | `ddsolrad` |
| **srunoff_module** | Module name for surface-runoff/infiltration computation method (`srunoff_carea` or `srunoff_smidx`) | module selection | 1 | 4 | `srunoff_smidx` |
| **strmflow_module** | Module name for streamflow routing simulation method (`strmflow`, `muskingum`, or `strmflow_in_out`) | module selection | 1 | 4 | `strmflow` |
| **subbasin_flag** | Flag to indicate if internal subbasin are computed (`0`=no; `1`=yes) | **nsub** > `0` | 1 | 1 | `1` |
| **temp_module** | Module name for temperature-distribution method (`climate_hru`, `temp_1sta`, `temp_dist2`, `temp_laps`, `ide_dist`, or `xyz_dist`) | module selection | 1 | 4 | `temp_1sta` |
| **transp_module** | Module name for transpiration simulation method | module selection | 1 | 4 | `transp_tindex` |

| Parameter name[4] | Description | Option | Number of Values | Data type | Default value |
|---|---|---|---|---|---|
| | (climate_hru, transp_frost, or transp_tindex) | | | | |
| | | Climate-by-HRU Files | | | |
| **cbh_binary_flag** | Flag to specify whether to input CBH files in a binary format using the samer order of values as the text file version (0=no; 1=yes) | input options | 1 | 1 | 0 |
| **humidity_cbh_flag** | Flag to specify whether to read a CBH file with humidity data (0=no; 1=yes) | **et_module** = potet_pm or potet_pt | 1 | 1 | 0 |
| **humidity_day**[2,3] | Pathname of the CBH file of pre-processed humidity input data for each HRU to specify variable *humidity_hru*-percentage | **et_module** = potet_pm, potet_pm_sta, or potet_pt | 1 | 4 | humidity.day |
| **orad_flag** | Flag to specify whether or not the variable *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*-inches | **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*-inches | **precip_module** = climate_hru | 1 | 4 | precip.day |
| **swrad_day**[2] | Pathname of the CBH file of pre-processed solar-radiation input data for each HRU to specify variable *swrad*-Langleys | **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*-degrees Fahrenheit | **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*-degrees Fahrenheit | **temp_module** = climate_hru | 1 | 4 | tmin.day |
| **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*-none | **transp_module** = climate_hru | 1 | 4 | transp.day |
| **windspeed_cbh_flag** | Flag to specify whether to read a CBH file with wind speed data (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*-meters/second | **et_module** = potet_pm | 1 | 4 | windspeed.day |
| | | Debug options | | | |
| **cbh_check_flag** | Flag to indicate if CBH values are validated each time step (0=no; 1=yes) | CBH input | 1 | 1 | 1 |
| **parameter_check_flag** | Flag to indicate if selected parameter values validation checks are treated as warnings or errors (0=no; 1=yes; 2=check parameters and then stop) | parameter validation check | 1 | 1 | 1 |
| **print_debug**[1] | Flag to indicate type of debug output | debug output | 1 | 1 | 0 |

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

| Parameter name[4] | Description | Option | Number of Values | Data type | Default value |
|---|---|---|---|---|---|
| **mapOutON_OFF** | Switch to specify whether or not mapped output file(s) by a specified number of columns (parameter **ncol**) of daily, weekly, monthly, yearly, or total simulation results is generated (0=no; 1=yes) | mapped results | 1 | 1 | 0 |
| **mapOutVar_names** | List of variable names for which output is written to mapped output files(s) | **map_resultsON_OFF** = 1 | **nmapOutVars** | 4 | none |
| **nmapOutVars** | Number of variables to include in mapped output file(s) | **map_resultsON_OFF** = 1 | 1 | 1 | 0 |
| | **nhru** Summary Results Files | | | | |
| **nhruOutBaseFileName**[2] | String to define the prefix for each **nhru** Summary Output File | **nhruOutON_OFF** = 1 | 1 | 4 | nhruout_path |
| **nhruOutON_OFF** | Switch to specify whether or not **nhru** Summary Output Files are generated (0=no; 1=yes) | **nhru** summary results | 1 | 1 | 0 |
| **nhruOutVar_names** | List of variable names for which output is written to **nhru** Summary Comma Separated Values (CSV) Output 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. Variables must be of type real or double | **nhruOutON_OFF** = 1 | **nhruOutVars** | 4 | none |
| **nhruOutVars** | Number of variables to include in **nhru** Summary Output File(s) | **nhruOutON_OFF** = 1 | 1 | 1 | 0 |
| **nhruOut_freq** | Output frequency and type (1=daily; 2=monthly; 3=both; 4=mean monthly; 5=mean yearly; 6=yearly) | **nhruOutON_OFF** = 1 | 1 | 1 | 1 |
| | **nsegment** Summary Files | | | | |
| **nsegmentOutBaseFileName**[2] | String to define the prefix for each **nsegment** Summary Output File. | **nsegmentOutON_OFF** = 1 | 1 | 4 | nsegmentout_path |
| **nsegmentOutON_OFF** | Switch to specify whether or not **nsegment** Summary Output Files are generated (0=no; 1=yes) | **nsegment** summary results | 1 | 1 | 0 |
| **nsegmentOutVar_names** | List of variable names for which output is written to **nsegment** Summary Comma Separated Values (CSV) Output Files(s). Each variable is written to a separate file with the prefix of each file equal to the value of **negmentOutBaseFileName**; variables must be of type real or double. Each variable is written to a separate file with the prefix of each file equal to the value of **nsegmentOutBaseFileName**. The suffix of the files is based on the value of **nsegmentOut_freq** and will be .csv; _meanyearly.csv; _yearly.csv; _meanmonthly.csv; or | **nsegmentOutON_OFF** = 1 | **nsegmentOutVars** | 4 | none |

| Parameter name[4] | Description | Option | Number of Values | Data type | Default value |
|---|---|---|---|---|---|
| | _monthly.csv. Variables must be of type real or double | | | | |
| **nsegmentOutVars** | Number of variables to include in **nsegment** Summary Output File(s) | **nsegmentOutON_OFF** = 1 | 1 | 1 | 0 |
| **nsegmentOut_freq** | Output frequency and type (1=daily; 2=monthly; 3=both; 4=mean monthly; 5=mean yearly; 6=yearly) | **nsegmentOutON_OFF** = 1 | 1 | 1 | 1 |
| | **nsub** Summary Files | | | | |
| **nsubOutBaseFileName**[2] | String to define the prefix for each **nsub** Summary Output File. | **nsubOutON_OFF** = 1 | 1 | 4 | nsubout_path |
| **nsubOutON_OFF** | Switch to specify whether or not **nsub** Summary Output Files are generated (0=no; 1=yes) | **nsub** summary results | 1 | 1 | 0 |
| **nsubOutVar_names** | List of variable names for which output is written to **nsub** Summary Comma Separated Values (CSV) Output Files(s). Each variable is written to a separate file with the prefix of each file equal to the value of **nsubOutBaseFileName**; variables must be of type real or double. Each variable is written to a separate file with the prefix of each file equal to the value of **nsubOutBaseFileName**. The suffix of the files is based on the value of **nsubOut_freq** and will be .csv; _meanyearly.csv; _yearly.csv; _meanmonthly.csv; or _monthly.csv. Variables must be of type real or double | **nsubOutON_OFF** = 1 | **nsubOutVars** | 4 | none |
| **nsubOutVars** | Number of variables to include in **nsub** Summary Output File(s) | **nsubOutON_OFF** = 1 | 1 | 1 | 0 |
| **nsubOut_freq** | Output frequency and type (1=daily; 2=monthly; 3=both; 4=mean monthly; 5=mean yearly; 6=yearly) | **nsubOutON_OFF** = 1 | 1 | 1 | 1 |
| | Basin Summary Results Files | | | | |
| **basinOutBaseFileName**[2] | String to define the prefix for each Basin Summary Output File. | **basinOutON_OFF** = 1 | 1 | 4 | basinout_path |
| **basinOutON_OFF** | Switch to specify whether or not basin Summary Output Files are generated (0=no; 1=yes) | Basin summary results | 1 | 1 | 0 |
| **basinOutVar_names** | List of variable names for which output is written to Basin Summary Comma Separated Values (CSV) Output Files(s). Each variable is written to a separate file with the prefix of each file equal to the value of **basinOutBaseFileName**; variables must be of type real or double. Each variable is written to a separate file with the prefix of each file equal to the value of **basinOutBaseFileName**. The suffix of the files is based on the value of **basinOut_freq** and will be .csv; _meanyearly.csv; _yearly.csv; _meanmonthly.csv; or _monthly.csv. Variables must be of type real or double | **basinOutON_OFF** = 1 | **basinOutVars** | 4 | none |
| **basinOutVars** | Number of variables to include in Basin Summary Output File(s) | **basinOutON_OFF** = 1 | 1 | 1 | 0 |
| **basinOut_freq** | Output frequency and type (1=daily; 2=monthly; 3=both; 4=mean | **basinOutON_OFF** = 1 | 1 | 1 | 1 |

| Parameter name[4] | Description | Option | Number of Values | Data type | Default value |
|---|---|---|---|---|---|
| | monthly; 5=mean yearly; 6=yearly) | | | | |
| | 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-IV executable | **ndispGraphs** > 0 | 1 | 4 | MOWS executable |
| **executable_model**[2] | Pathname (full or relative) of the PRMS-IV executable | **ndispGraphs** > 0 | 1 | 4 | prmsIV |
| **initial_deltat** | Initial time step for the simulation | **ndispGraphs** > 0 | 1 | 2 | 24.0 |
| **ndispGraphs** | Number of plots included in the runtime graph | graphical output | 1 | 1 | 0 |

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

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

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

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

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

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

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

| Parameter name | Description | Dimension[1] | Type | Units | Range | Default | Required/condition |
|---|---|---|---|---|---|---|---|
| | | | | | | | **mapOutON_OFF** = 1 |
| **gvr_hru_pct** | Proportion of the HRU area associated with each gravity reservoir | **nhrucell** | real | decimal fraction | 0.0 to 1.0 | 0.0 | **nhru** not equal to **nhrucell** and **model_mode** = `GSFLOW` |
| **id_obsrunoff** | Index of measured streamflow station corresponding to the basin outlet | **one** | integer | none | 0 to **nobs** | 0 | **model_mode** = `GSFLOW` |
| **lake_hru_id** | Identification number of the lake associated with an HRU; more than one HRU can be associated with each lake | **nhru** | integer | none | 0 to **nlake** | 0 | required when any HRU has **hru_type** specified equal to 2 |
| **mxsziter** | Maximum number of iterations soilzone states are computed | **one** | integer | none | 0 to user defined | MODFLOW convergence criterion | **model_mode** = `GSFLOW` |
| | | | | Measured input | | | |
| **outlet_sta** | Index of measured streamflow station corresponding to the basin outlet | **one** | integer | none | 0 to **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 |
| | | | | Air temperature and precipitation distribution | | | |
| **adjmix_rain** | Monthly (January to December) factor to adjust rain proportion in a mixed rain/snow event | **nhru, nmonths** | real | decimal fraction | 0.0 to 3.0 | 1.0 | required |
| **adjust_rain** | Monthly (January to December) rain downscaling adjustment factor for each precipitation measurement station | **nrain, nmonths** | real | decimal fraction | -0.5 to 0.5 | -0.4 | **precip_module** = `ide_dist` or `xyz_dist` |
| **adjust_snow** | Monthly (January to December) snow downscaling | **nrain,** | real | decimal | -0.5 to 0.5 | -0.4 | **precip_module** = |

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

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

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

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

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

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

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

| Parameter name | Description | Dimension[1] | Type | Units | Range | Default | Required/condition |
|---|---|---|---|---|---|---|---|
| | winter day with greater than **ppt_rad_adj** inches precipitation for each HRU | | | fraction | | | |
| **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` |
| **epan_coef** | Monthly (January to December) evaporation pan coefficient for each HRU | **nhru, nmonths** | real | decimal fraction | 0.01 to 3.0 | 1.0 | **et_module** = `potet_pan` |
| **hamon_coef** | Monthly (January to December) air temperature coefficient used in Hamon potential ET computations for each HRU | **nhru, nmonths** | real | none | 0.004 to 0.008 | 0.0055 | **et_module** = `potet_hamon` |
| **hru_humidity_sta** | Index of humidity measurement station for each HRU | **nhru** | integer | none | 0 to **nhumid** | 0 | **et_module** = `potet_pm_sta` and **nhumid** > 0 |
| **hru_pansta** | Index of pan evaporation station used to compute HRU potential ET | **nhru** | integer | none | 0 to **nevap** | 0 | **et_module** = `potet_pan` and **nevapl** > 0 |
| **hru_windspeed_sta** | Index of wind speed measurement station for each HRU | **nhru** | integer | none | 0 to **nwind** | 0 | **et_module** = `potet_pm_sta` and **nwind** > 0 |
| **hs_krs** | Monthly (January to December) adjustment factor used in Hargreaves-Samani potential ET computations for each HRU | **nhru, nmonths** | real | decimal fraction | 0.01 to 0.24 | 0.0135 | **et_module** = `potet_hs` |
| **humidity_percent** | Monthy humidity for each HRU | **nhru, nmonths** | real | percentage | 0.0 to 100.0 | 0.0 | **et_module** = `potet_pm` or `potet_pt` and humidity CBH File (**humidity_day**) is not specified |
| **jh_coef** | Monthly (January to December) air temperature coefficient used in Jensen-Haise potential ET computations for each HRU | **nhru, nmonths** | real | per degrees Fahrenheit | 0.0 to 0.1 | 0.014 | **et_module** = `potet_jh` |
| **jh_coef_hru** | Air temperature coefficient used in Jensen-Haise potential ET computations for each HRU | **nhru** | real | per degrees Fahrenheit | -99.0 to 150.0 | 13.0 | **et_module** = `potet_jh` |
| **lake_evap_adj** | Monthly (January to December) adjustment factor for | **nhru** | real | decimal | 0.5 to 1.0 | 1.0 | required when any |

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

| Parameter name | Description | Dimension[1] | Type | Units | Range | Default | Required/condition |
|---|---|---|---|---|---|---|---|
| **covden_win** | Winter vegetation cover density for the major vegetation type in each HRU | **nhru** | real | decimal fraction | 0.0 to 1.0 | 0.5 | required |
| **snow_intcp** | Snow interception storage capacity for the major vegetation type in each HRU | **nhru** | real | inches | 0.0 to 1.0 | 0.1 | required |
| **srain_intcp** | Summer rain interception storage capacity for the major vegetation type in each HRU | **nhru** | real | inches | 0.0 to 1.0 | 0.1 | required |
| **wrain_intcp** | Winter rain interception storage capacity for the major vegetation type in each HRU | **nhru** | real | inches | 0.0 to 1.0 | 0.1 | required |
| | | Snow computaions | | | | | |
| **albset_rna** | Fraction of rain in a mixed precipitation event above which the snow albedo is not reset; applied during the snowpack accumulation stage | **one** | real | decimal fraction | 0.5 to 1.0 | 0.8 | required |
| **albset_rnm** | Fraction of rain in a mixed precipitation event above which the snow albedo is not reset; applied during the snowpack melt stage | **one** | real | decimal fraction | 0.4 to 1.0 | 0.6 | required |
| **albset_sna** | Minimum snowfall, in water equivalent, needed to reset snow albedo during the snowpack accumulation stage | **one** | real | inches | 0.01 to 1.0 | 0.05 | required |
| **albset_snm** | Minimum snowfall, in water equivalent, needed to reset snow albedo during the snowpack melt stage | **one** | real | inches | 0.1 to 1.0 | 0.2 | required |
| **cecn_coef** | Monthly (January to December) convection condensation energy coefficient for each HRU | **nhru, nmonths** | real | calories per degree Celsius > 0 | 0.02.0 to 20.0 | 5.0 | required |
| **den_init** | Initial density of new-fallen snow | **one** | real | grams/cubic centimeters | 0.01 to 0.5 | 0.1 | required |
| **den_max** | Average maximum snowpack density | **one** | real | grams/cubic centimeters | 0.1 to 0.8 | 0.6 | required |
| **emis_noppt** | Average emissivity of air on days without precipitation for each HRU | **nhru** | real | decimal fraction | 0.757 to 1.0 | 0.757 | required |
| **freeh2o_cap** | Free-water holding capacity of snowpack expressed as a decimal fraction of the frozen water content of the snowpack (*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 | required |
| **melt_force** | Julian date to force snowpack to spring snowmelt stage; varies with region depending on length of time that permanent snowpack exists for each HRU | **nhru** | integer | Julian day | 1 to 366 | 140 | required |
| **melt_look** | Julian date to start looking for spring snowmelt stage; varies with region depending on length of time that permanent snowpack exists for each HRU | **nhru** | integer | Julian day | 1 to 366 | 90 | required |
| **settle_const** | Snowpack settlement time constant | **one** | real | decimal | 0.01 to 0.5 | 0.1 | required |

| Parameter name | Description | Dimension[1] | Type | Units | Range | Default | Required/condition |
|---|---|---|---|---|---|---|---|
| **snarea_curve** | Snow area depletion curve values, 11 values for each curve (0.0 to 1.0 in 0.1 increments) | **ndeplval** | real | fraction decimal fraction | 0.0 to 1.0 | 1.0 | required |
| **snarea_thresh** | Maximum threshold snowpack water equivalent below which the snow-covered-area curve is applied~~; varies with elevation~~ | **nhru** | real | inches | 0.0 to 200.0 | 50.0 | required |
| **snowpack_init** | Storage of snowpack in each HRU at the beginning of a simulation | **nhru** | real | inches | 0.0 to 5000.0 | 0.0 | required |
| **tstorm_mo** | Monthly indicator for prevalent storm type (`0`=frontal storms; `1`=convective storms) for each HRU | **nhru, nmonths** | integer | none | 0 or 1 | 0 | required |
| | Hortonian surface runoff, infiltration, and impervious storage | | | | | | |
| **carea_max** | Maximum possible area contributing to surface runoff expressed as a portion of the HRU area | **nhru** | real | 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**[2] | Fraction of each HRU area that is impervious | **nhru** | real | decimal fraction | 0.0 to 0.999 | 0.0 | required |
| **imperv_stor_max** | Maximum impervious area retention storage for each HRU | **nhru** | real | inches | 0.0 to 0.5 | 0.05 | required |
| **smidx_coef** | Coefficient in non-linear contributing area algorithm for each HRU | **nhru** | real | decimal fraction | 0.0 to 1.0 | 0.005 | **srunoff_module** = `srunoff_smidx` |
| **smidx_exp** | Exponent in non-linear contributing area algorithm for each HRU | **nhru** | real | 1/inch | 0.0 to 1.0 | 0.3 | **srunoff_module** = `srunoff_smidx` |
| **snowinfil_max** | Maximum snow infiltration per day for each HRU | **nhru** | real | inches/day | 0.0 to 20.0 | 2.0 | required |
| | Surface depression storage | | | | | | |
| **dprst_area** | Aggregate sum of surface-depression storage areas of each HRU (recommend that **dprst_frac_hru** be used instead of **dprst_area**) | **nhru** | real | acres | 0.0 to 1.0E9 | 0.0 | **dprst_flag** = 1 |
| **dprst_depth_avg** | Average depth of storage depressions at maximum storage capacity | **nhru** | real | inches | 0.0 to 500.0 | 132.0 | **dprst_flag** = 1 |
| **dprst_et_coef** | Fraction of unsatisfied potential evapotranspiration to apply to surface-depression storage | **nhru** | real | decimal fraction | 0.0 to 1.0 | 1.0 | **dprst_flag** = 1 |
| **dprst_flow_coef** | Coefficient in linear flow routing equation for open surface depressions for each HRU | **nhru** | real | fraction/day | 0.00001 to 0.5 | 0.05 | **dprst_flag** = 1 |
| **dprst_frac_hru** | Fraction of each HRU area that has surface depressions (If specified the parameter dprst_area is ignored if it also is specified) | **nhru** | real | decimal fraction | -1.0 to 0.999 | -1.0 | **dprst_flag** = 1 |
| **dprst_frac_init** | Fraction of maximum surface-depression storage that contains water at the start of a simulation | **nhru** | real | decimal fraction | 0.0 to 1.0 | 0.5 | **dprst_flag** = 1 |

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

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

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

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

| Parameter name | Description | Dimension[1] | Type | Units | Range | Default | Required/condition |
|---|---|---|---|---|---|---|---|
| | | | | | | | and **ncascade** > 0 |

[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.

[9]Parameter name is based on parameter of same name specified for the Groundwater and Surface-Water Flow (GSFLOW) model (Markstrom and others, 2008). Only required if the HRU map is different than the target map, that is, dimension **nhru** not equal to **ngwcell**.

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

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

| Variable | Definition | Units | Valid range | Dimension[1] |
|---|---|---|---|---|
| *humidity* | Relative humidity at each measurement station | percentage | 0.0 to 1.0 | **nhumid** |
| *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** |
| *tmax* | Maximum air temperature at each measurement station | **temp_units** | -99.0 to 150.0 | **ntemp** |
| *tmin* | Minimum air temperature at each measurement station | **temp_units** | -99.0 to 150.0 | **ntemp** |
| *wind_speed* | Wind speed at each measurement station | **miles per hour** | 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, version 4 (PRMS-IV).
[HRU, hydrologic response unit; GWR, groundwater reservoir; CBH, climate-by-HRU; ET, evapotranspiration; cfs: cubic feet per second; cms: cubic meters per second; >, greater than; **runoff_units**, 0=cfs; 1=cms; **precip_units**, 0=inches; 1=millimeters; **temp_units**, 0=degrees Fahrenheit; 1=degrees Celsius; control parameters **temp_module**, **precip_module**, **et_module**, **strmflow_module**, **model_mode**, **dprst_flag**, **subbasin_flag**, **cascade_flag**, and **cascadegw_flag** defined in table 1-2]

| Variable name | Description | Dimension[1] | Units | Data type | Availabilty/condition |
|---|---|---|---|---|---|
| | | Climate distribution | | | |
| *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 throughfall | **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 |
| *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** = `xyz_dist` |
| *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 |
| *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 |
| *rain_day* | Flag to set the form of any precipitation to rain (0=determine form; 1=rain) | **one** | none | integer | **precip_module** = `xyz_dist` |
| *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` |
| *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 or potet_pm_sta |
| | | 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_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* | 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 |
| *soltab_horad_potsw* | Potential solar radiation on a horizontal plane for each Julian Day, for each HRU | **ndays, nhru** | Langleys | double | always |
| *soltab_potsw* | Potential solar radiation for each Julian Day, for each HRU | **ndays, nhru** | Langleys | double | 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 |
| | | Interception | | | |

| | | | | | |
|---|---|---|---|---|---|
| *basin_intcp_stor* | Basin area-weighted average interception storage | **one** | inches | double | always |
| *basin_net_rain* | Basin area-weighted average rain throughfall | **one** | inches | double | always |
| *basin_net_snow* | Basin area-weighted average snow throughfall | **one** | inches | double | always |
| *canopy_covden* | Canopy cover density fo each HRU | **nhru** | decimal fraction | real | always |
| *hru_intcpstor* | Interception storage in the canopy for each HRU | **nhru** | inches | real | always |
| *intcp_form* | Form (rain or 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 |
| | | 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 |
| *basin_pk_precip* | Basin area-weighted average precipitation added to snowpack | **one** | inches | double | always |
| *basin_pweqv* | Basin area-weighted average snowpack water equivalent | **one** | inches | double | always |
| *basin_snowcov* | Basin area-weighted average snow-covered area | **one** | decimal fraction | double | always |
| *basin_snowdepth* | Basin area-weighted average snow depth | **one** | inches | double | always |
| *basin_snowevap* | Basin area-weighted average evaporation and sublimation from snowpack | **one** | inches | double | always |
| *basin_snowmelt* | Basin area-weighted average snowmelt | **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* | Yeary 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 |
| *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 |
| *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 |
| *slst* | Days since last new snow for each HRU | **nhru** | days | real | always |
| *snow_evap* | Evaporation and sublimation from snowpack on each HRU | **nhru** | inches | real | always |
| *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 |
| *snowdepth* | Snow depth at each measurement station | **nhru** | inches | real | always |
| *snowmelt* | Snowmelt from snowpack on each HRU | **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 |

| | | | | | |
|---|---|---|---|---|---|
| | | 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 |
| *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_humidity* | Basin area-weighted average 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_intcp_evap* | Basin area-weighted evaporation from the canopy | **one** | inches | double | always |
| *basin_intcp_evap_mo* | Monthly basin basin area-weighted average interception evaporation | **one** | inches | double | always |
| *basin_intcp_evap_tot* | Total simulation basin basin area-weighted average interception evaporation | **one** | inches | double | always |
| *basin_intcp_evap_yr* | Yearly basin basin area-weighted average interception evaporation | **one** | inches | double | always |
| *basin_lakeevap* | Basin area-weighted average lake evaporation | **one** | inches | double | **nlake** > `0` |
| *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_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 average wind speed | **one** | decimal fraction | 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` |
| *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_impoervevap* | HRU area-weighted average evaporation from impervious area for each HRU | **nhru** | inches | real | always |
| *hru_intcpevap* | Evaporation from the canopy for each HRU | **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 |
| *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 |

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| *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* | Area-weighted average potential ET for each segment from HRUs contributing flow to the segment | **nsegment** | inches | double | **strmflow_module** = `muskingum` or `strmflow_in_out` |
| *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` or `potet_pm_sta` |
| *vp_slope* | Slope of saturation vapor pressure versus air temperature curve for each HRU | **nhru** | kilopascals/degrees Celsius | real | **et_module** = `potet_pm`, `potet_pm_sta`, or `potet_pt` |
| | Hortonian surface runoff, infiltration, and impervious storage | | | | |
| *basin_cap_infil_tot* | Basin area-weighted average infiltration with cascading flow into capillary reservoirs | **one** | inches | double | always |
| *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 |

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| *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_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 **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* | Surface runoff from impervious areas for each HRU | **nhru** | inches | real | always |
| *hru_sroffp* | Surface runoff from pervious areas for 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* | 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 | | | | |
| *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 | **one** | inches | double | **dprst_flag** = 1 |

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| | depressions | | | | |
| *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 |
| *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 | double | **dprst_flag** = 1 |
| *dprst_vol_frac* | Fraction of surface-depression storage of the maximum storage for each HRU | **nhru** | decimal fraction | double | **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 | double | **dprst_flag** = 1 |
| *hru_frac_dprst* | Fraction of HRU that has surface-depression storage | **nhru** | decimal fraction | real | **dprst_flag** = 1 |
| | Soil zone storage, interflow, gravity drainage, Dunnian surface runoff | | | | |
| *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 |

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| | | | | | **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-flow reservoirs from variable *infil* | **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 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 | **one** | decimal fraction | double | always |

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| | storage of the maximum storage | | | | |
| *basin_soil_to_gw* | Basin area-weighted average excess flow to capillary reservoirs that drains to GWRs | **one** | inches | double | always |
| *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 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_sz_cascadeflow* | Cascading interflow and Dunnian surface runoff from each HRU | **nhru** | inches | real | **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 and maximum soil saturation minus the any’ preferential-flow storage | **nhru** | inches | real | always |
| *recharge* | Recharge to the associated GWR as sum of *soil_to_gw* and’ *ssr_to_gw* for each HRU | **nhru** | inches | real | always |
| *seginc_ssflow* | Area-weighted average interflow for each segment from HRUs contributing flow to the segment | **nsegment** | cfs | double | **nsegment** > 0 |
| *slow_flow* | Interflow from gravity reservoir that flows to the stream network for | **nhru** | inches | real | always |

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| | each HRU | | | | |
| *slow_stor* | Storage of gravity reservoir for each HRU | **nhru** | inches | real | always |
| *soil_lower* | Storage in the lower zone of the capillary reservoir that is only available for transpiration for each HRU | **nhru** | inches | real | always |
| *soil_lower_ratio* | Water content ration in the lower zone of the capillary reservoir for each HRU | **nhru** | decimal fraction | real | always |
| *soil_moist* | Storage of capillary reservoir for each HRU | **nhru** | inches | real | always |
| *soil_moist_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_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 subbasin | **nsub** | inches | double | **subbasin_flag** = 1 |
| *subinc_szstor_frac* | Area-weighted average fraction of soil-zone water content storage for associated HRUs of each subbasin | **nsub** | decimal fraction | double | **subbasin_flag** = 1 |
| *upslope_dunnianflow* | Cascading Dunnian surface runoff that flows to the capillary reservoir of each downslope HRU for each upslope HRU | **nhru** | inches | double | **cascade_flag** = 1 and **ncascade** > 0 |
| *upslope_interflow* | Cascading interflow runoff that flows to the capillary reservoir of each downslope HRU for each upslope HRU | **nhru** | inches | double | **cascade_flag** = 1 and **ncascade** > 0 |
| | | Groundwater flow | | | |
| *basin_gwflow* | Basin area-weighted average groundwater flow to the stream network | **one** | inches | double | always |
| *basin_gwflow_cfs* | Basin area-weighted average groundwater flow to the stream network | **one** | cfs | double | always |

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| *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_in_soil* | Drainage from capillary reservoir excess water for each GWR | **ngw** | acre-inches | double | always |
| *gw_in_ssr* | Drainage from gravity reservoir excess water for each GWR | **ngw** | acre-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 |
| *seginc_gwflow* | 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 | always |
| *basin_cfs_tot* | Total simulation basin area-weighted average streamflow | **one** | cfs | double | always |
| *basin_cfs_yr* | Yearly total streamflow to stream network | **one** | cfs | double | always |
| *basin_cms* | Streamflow leaving the basin through the stream network | **one** | cms | double | always |
| *basin_runoff_ratio* | Basin area-weighted average discharge/precipitation | **one** | decimal fraction | double | always |
| *basin_runoff_ratio_mo* | Monthly area-weighted average discharge/precipitation | **one** | decimal fraction | double | always |
| *basin_segment_storage* | Basin area-weighted average storage in the stream network | **one** | inches | double | always |
| *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 | always |

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

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|---|---|---|---|---|---|
| *lakein_sz* | Cascading interflow and Dunnian surface runoff to lake HRUs for each upslope HRU | **nhru** | inches | double | **cascade_flag** = 1, **ncascade** > 0, and **nlake** > 0 |
| | Water balance | | | | |
| *basin_capillary_wb* | Basin area-weighted average capillary reservoir storage | **one** | inches | double | **print_debug** = 1 |
| *basin_dprst_wb* | Basin area-weighted average surface-depresion 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 |
| *hru_lateral_flow* | Lateral flow to stream network from each HRU | **nhru** | cfs | 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 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 |
| | GSFLOW | | | | |
| *ActualET_Q* | Volumetric flow rate of actual evaporation from HRUs | **one** | L3/T | double | **model_mode**=GSFLOW |
| *Ave_SoilDrainage2Unsat_Q* | Running average gravity drainage to the unsaturated and saturated zones | **one** | L3 | double | **model_mode**=GSFLOW |
| *BoundaryStreamFlow_Q* | Volumetric specified streamflow into the model domain to SFR | **one** | L3/T | double | **model_mode**=GSFLOW |
| *CanopyEvap_Q* | Volumetric flow rate of evaporation of intercepted precipitation | **one** | L3/T | double | **model_mode**=GSFLOW |
| *Canopy_S* | Volume of intercepted precipitation in plant-canopy reservoirs | **one** | L3 | double | **model_mode**=GSFLOW |
| *CapDrainage2Sat_Q* | Volumetric flow rate of direct gravity drainage from excess capillary water to the unsaturated zone | **one** | L3/T | double | **model_mode**=GSFLOW |
| *CapET_Q* | Volumetric flow rate of evapotranspiration from pervious areas | **one** | L3/T | double | **model_mode**=GSFLOW |
| *Cap_S* | Volume of water in capillary reservoirs of the soil zone | **one** | L3 | double | **model_mode**=GSFLOW |
| *DprstEvap_Q* | Volumetric flow rate of evaporation from surface depressions | **one** | L3/T | double | **model_mode**=GSFLOW |
| *Dprst_S* | Volume of water stored in surface-depression storage | **one** | L3 | double | **model_mode**=GSFLOW |
| *DunnInterflow2Cap_Q* | Volumetric flow rate of cascading Dunnian runoff and interflow to HRUs | **one** | L3/T | double | **model_mode**=GSFLOW |
| *DunnInterflow2Lake_Q* | Volumetric flow rate of interflow and Dunnian surface runoff to lakes | **one** | L3/T | double | **model_mode**=GSFLOW |
| *DunnSroff2Stream_Q* | Volumetric flow rate of Dunnian runoff to streams | **one** | L3/T | double | **model_mode**=GSFLOW |

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

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

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

[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.