HRU Summary Output Option – Module nhru_summary

The new `nhru_summary` module was developed to add the capability to write time-series comma-separated values (CSV) format files, named Nhru Summary Files, of daily, monthly, and/or mean monthly values of user-selected variables for each Hydrologic Response Unit (HRU). The CSV format allows simulation results to be analyzed and visualized through direct input of the Nhru Summary Files to many statistical and graphical software packages, such as Microsoft Xcel, Google Spreadsheets, GNU R, and Math Works MATLAB. Additionally, these files could be used to generate input information required for other simulation codes; that is, a method to loosely couple PRMS with other simulation codes.

Any number of variables that are dimensioned by the value of **nhru** can be output. A separate file is generated for each selected variable that contains the number of values per line equal to the number of HRUs. The module provides for specification of a warm-up time period (parameter **prms_warmup** in the Parameter File) to allow the simulation results to reach equilibrium between applied climatic conditions and dynamic surface hydrologic processes prior to the writing to Nhru Summary Files. Several new control parameters, which are specified in the Control File, have been added to specify whether or not to output Nhru Summary Files, the number and name of output variables, and the base file name for each file (table 1). Each output file has the name of the variable appended to the base file name.

Table 1. Input parameters to the NHRU Summary Module—nhru_summary.

Parameter name	Description	Number of values	Data type	Range	Default value
Parameters input in the Control File					
nhruOutBaseFileName[1]	Base pathname for each Nhru Summary Output File; the name of the selected variable is appended to this value	1	character	user defined	none
nhruOutON_OFF	Switch to specify whether or not Nhru Summary Output File(s) are generated (0=no; 1=yes)	1	integer	0 or 1	0
nhruOutVar_names[2]	List of variable names for which output is written to Nhru Summary Output File(s)	**nhruOutVars**	character	user defined	none
nhruOutVars	Number of variables to include in Nhru Summary Output File(s)	1	integer	user defined	0
nhruOut_freq	Output frequency and type (`0`=daily; `1`=monthly; `3`=daily and monthly; and `4`=mean monthly)	1	integer	0 to 4	0
Parameter input in the Parameter File(s)					
prms_warmup	Number of years to simulate before writing nhru summary output file(s)	1	integer	0 to user defined	1

[1]Pathnames can be specified by using a maximum of 132 characters.

[2]Variable names can have a maximum of 36 characters.

Figure 1 shows a portion of a Control File to specify the parameters required to produce three Nhru Summary Files. One daily file is created for each output type: potential ET, actual ET, and recharge with the filenames, `./modeltest/prmsIV_potet.csv`, `./modeltest/prmsIV_hru_actet.csv`, and `./modeltest/prmsIV_recharge.csv`, respectively.

```
####
nhruOutBaseFileName
1
4
./modeltest/prmsIV_
####
nhruOutON_OFF
1
1
1
####
nhruOutVars_names
3
4
potet
hru_actet
recharge
####
nhruOutVars
1
1
3
####
nhruOut_freq
1
1
1
```

Figure 1. Example portion of a Control File used with the nhru_summary module