

VIII.3.3-WATERBAL WATER BALANCE SUMMARY OPERATION

Identifier: WATERBAL

Operation Number: 40

Parameter Array: The FORTRAN identifier used for the parameter array is PO. The contents of the PO array are:

<u>Position</u>	<u>Contents</u>
1	Version number of the operation
2-6	Basin description (20 characters)
7-8	Observed discharge time series (mean daily) identifier
9	Observed discharge time series data type
10-11	Simulated discharge time series (mean daily) identifier
12	Simulated discharge time series data type
13	Area (KM2)
14	Number of subareas
15	Flag to display yearly (water year) water balance
16	Record number of the first record used by this operation on the water year scratch file
17	Location of first scratch file record used by the multi-year zone contents display option: 0 = display option not selected
18-22	Unused
23-27	Subarea name
28	Fraction of area represented
29-30	Snow operation type
31-32	Snow operation name
33	Location of water balance sums and melt components in the PS array: 0 = no sums stored
34-35	Rainfall-runoff operation type

<u>Position</u>	<u>Contents</u>
36-37	Rainfall-runoff operation name
38	Location of sums of water balance, runoff and ET components in the PL/PO array: 0 = no sums stored
39	Location of parameter values in the PL/PO array

Positions PO(23)-PO(39) are repeated for each basin subarea.

Scratch File: Computed end of month values are stored in the water year scratch file. A separate record is used to store each month's values. A record contains 30 values if the Sacramento model is being used. A record contains 16 values if the API-CONT model has been selected. At the end of each water year these values are written to a work array and plotted. If the multi-year zone contents display has been selected (Sacramento model only) an additional record will be used to store and compute values throughout the entire calibration period.

Carryover Array: The FORTRAN identifier used for the carryover array is CO. The contents of the CO array are:

<u>Position</u>	<u>Contents</u>
1	Sum of the weighted ET-demand
2	Sum of the weighted actual ET
3	Sum of the weighted precipitation
4	Sum of the weighted snowfall - computed only if snow model is used
5	Sum of the weighted rain+melt - computed only if snow model is used
6	Sum of the weighted storage change
7	Sum of the weighted recharge
8	Sum of the observed runoff
9	Sum of the simulated runoff
10	Total number of observed discharge values

Values CO(1)-CO(10) represent multi-year values computed for the entire calibration period. The sums stored in CO(11)-CO(20) are computed for the same quantities but for the current water year only. CO(21) holds the number of days in the current water year.

Subroutines Names and Functions: Subroutines associated with this Operation are:

<u>Subroutine</u>	<u>Function</u>
PIN40	Input information and stores values in the PO array
PRP40	Print information stored in the PO array
EX40	Execute the Operation
WTWY40	Compute and writes data to the scratch file each month - each scratch file record holds one month of data for a single subarea
MYWB40	Compute and write water balance data to CO array - the first part of the CO array holds the multi-year values - the second part holds the yearly values
MYZC40	Compute and write the optional multi-year average, high and low zone contents (Sacramento model only) to the water year scratch file
PLOTWB	Print snow and rainfall-runoff model components for each month for each subarea at the end of the water year
PLOTZC	Print optional multi-year average, high and low zone contents
PLOTMY	Print the multi-year water balance summary and the optional yearly water balance summary
TAB40	Make entries into the Operations Table
PUC40	Generate card images from the PO array which can be read by the PIN40 subroutine

Subroutines PIN40, PRP40 and PUC40 have the standard argument lists for these subroutines as described in section VIII.4.3. Subroutine PIN40 also has passed to it the entire P array and work space used to store the beginning locations of the second part of the PL/PO arrays of the rainfall-runoff models used.

SUBROUTINE EX40 (PO,CO,P,MP,C MC,LOCPS,LOCCS,LOCPL,LOCCL,QO,QS,WORK)

Function: This is the execution subroutine for Operation WATERBAL.

Argument List:

<u>Variable</u>	<u>Input/ Output</u>	<u>Type</u>	<u>Dimension</u>	<u>Description</u>
PO	Input	R*4	Variable	Contains parameters and other information
CO	Both	R*4	Variable	Contains carryover values
P	Input	R*4	MP	The entire P array
MP	Input	I*4	1	Dimension of the P array
C	Input	R*4	MC	The entire C array
MC	Input	I*4	1	Dimension of the C array
LOCPS	Input	I*4	Variable	Array containing pointers to the first position of the second part of the parameter array for the snow model
LOCCS	Input	I*4	Variable	Array containing pointers to the first position of the carryover array for the snow model
LOCPL	Input	I*4	Variable	Array containing pointers to the first position of the second part of the parameter array for the rainfall-runoff model
LOCCL	Input	I*4	Variable	Array containing pointers to the first position of the carryover array for the rainfall-runoff model
QO	Input	R*4	Variable	Observed discharge time series for the current month
QS	Input	R*4	Variable	Simulated discharge time series for the current month
WORK	Both	R*4	Variable	Temporary work space used to hold data for printing multi-year average zone contents

SUBROUTINE WTWY40 (PO,P,MP C,MC,LOCPS,LOCPL,LOCCS,LOCCL,NREC,NOSUB,
IBUG,IAPI,NVAL)

Function: Subroutine WTWY40 computes the end of month sums of rainfall-runoff and snow model components and writes them to the scratch file. Each scratch file record holds one month of data for a single subarea.

Argument List:

<u>Variable</u>	<u>Input/ Output</u>	<u>Type</u>	<u>Dimension</u>	<u>Description</u>
PO	Input	R*4	Variable	Contains parameters and other information
P	Input	R*4	MP	The entire P array
MP	Input	I*4	1	Dimension of the P array
C	Input	R*4	MC	The entire C array
MC	Input	I*4	1	Dimension of the C array
LOCPS	Input	I*4	Variable	Array containing pointers to the first position of the second part of the parameter array for the snow model
LOCPL	Input	I*4	Variable	Array containing pointers to the first position of the second part of the parameter array for the rainfall-runoff model
LOCCS	Input	I*4	Variable	Array containing pointers to the first position of the carryover array for the snow model
LOCCL	Input	I*4	Variable	Array containing pointers to the first position of the carryover array for the rainfall-runoff model
NREC	Both	I*4	1	Number of the current scratch file record having data written to it
NOSUB	Input	I*4	1	Total number of subareas
IBUG	Input	I*4	1	Debug indicator: 0 = no debug output 1 = debug output
IAPI	Input	I*4	1	Indicator if API-CONT model is

<u>Variable</u>	<u>Input/ Output</u>	<u>Type</u>	<u>Dimension</u>	<u>Description</u>
				being used: 0 = no 1 = yes
NVAL	Input	I*4	1	Number of end of month sums of rainfall-runoff and snow model components to be printed: 30 for Sacramento Model 16 for API-CONT Model

SUBROUTINE MYWB40 (PO,P,CO,LOCPS,LOCPL,QO,QS,NOSUB,IOPT1,IDAY,LASTDA,
MOWY,ITOTDA,IBUG,IAPI)

Function: Subroutine MYWB40 computes and writes water balance data to CO array. The first part of the CO array holds the multi-year values. The second part holds the yearly values.

Argument List:

<u>Variable</u>	<u>Input/ Output</u>	<u>Type</u>	<u>Dimension</u>	<u>Description</u>
PO	Input	R*4	Variable	Contains parameters and other information
P	Input	R*4	Variable	The entire P array
CO	Both	R*4	Variable	Array contains multi-year and yearly water balance data values
LOCPS	Input	I*4	Variable	Array containing pointers to the first position of the second part of the parameter array for the snow model
LOCPL	Input	I*4	Variable	Array containing pointers to the first position of the second part of the parameter array for the rainfall-runoff model
QO	Input	R*4	Variable	Observed discharge time series for the current month
QS	Input	R*4	Variable	Observed discharge time series for the current month
NOSUB	Input	I*4	1	Total number of subareas
IOPT1	Output	I*4	1	Indicator if yearly water balance option not selected: 0 = no 1 = yes
IDAY	Input	I*4	1	First day of current month
LASTDA	Input	I*4	1	Last day of current month
MOWY	Input	I*4	1	Number of current month in water year
ITOTDA	Input	I*4	1	Total number of days in the entire calibration period
IBUG	Input	I*4	1	Debug indicator:

<u>Variable</u>	<u>Input/ Output</u>	<u>Type</u>	<u>Dimension</u>	<u>Description</u>
				0 = no debug output 1 = debug output
I-API	Input	I*4	1	Indicator if API-CONT model is being used: 0 = no 1 = yes

SUBROUTINE MYZC40 (PO,C,MC,LOCCL,NOSUB,MOWY,MONTH,KYEAR,IBUG)

Function: Subroutine MYZC40 computes and writes the optional multi-year average, high and low zone contents (Sacramento model only) to the water scratch file.

Argument List:

<u>Variable</u>	<u>Input/ Output</u>	<u>Type</u>	<u>Dimension</u>	<u>Description</u>
PO	Input	R*4	Variable	Contains parameters and other information
C	Input	R*4	MC	The entire C array
MC	Input	I*4	1	Dimension of the C array
LOCCL	Input	I*4	Variable	Array containing pointers to the first position of the carryover array for the rainfall-runoff model
NOSUB	Input	I*4	1	Total number of subareas
MOWY	Input	I*4	1	Number of current month in water year
MONTH	Input	I*4	1	Number of current month in calendar year
KYEAR	Input	I*4	1	Current calendar year
IBUG	Input	I*4	1	Debug indicator: 0 = no debug output 1 = debug output

SUBROUTINE PLOTWB (PO,VAL,SUM,MON,IMONTH,MONTH,KWY,KYR,I1,WT,IAPI,
ISV,IFI)

Function: Subroutine PLOTWB generates yearly tables of rainfall-runoff and snow model components.

Argument List:

<u>Variable</u>	<u>Input/ Output</u>	<u>Type</u>	<u>Dimension</u>	<u>Description</u>
PO	Input	R*4	Variable	Contains parameters and other information
VAL	Input	R*4	Variable	Array containing end of month rainfall-runoff and snow model component values
SUM	Both	R*4	Variable	Array containing yearly sums of end of month rainfall-runoff and snow model component values
MON	Input	R*4	12	Character array containing month names
IMONTH	Input	I*4	1	First month of the current water year
MONTH	Input	I*4	1	Last month of the current water year
KWY	Input	I*4	1	Current water year
KYR	Input	I*4	1	Current calendar year
I1	Input	I*4	1	Location of the first position in the PO array containing information specific to the current subarea
WT	Input	I*4	1	Weighting factor assigned to current subarea
IAPI	Input	I*4	1	Indicator if API-CONT model is being used: 0 = no 1 = yes
ISV	Input	I*4	1	First quadrant variability option integer for API-CONT model
IFI	Input	I*4	1	Location in PO array of API-CONT model frozen ground information

SUBROUTINE PLOTZC (PO,WORK,MON,I1,K)

Function: Subroutine PLOTZC generates the optional multi-year average zone contents display.

Argument List:

<u>Variable</u>	<u>Input/ Output</u>	<u>Type</u>	<u>Dimension</u>	<u>Description</u>
PO	Input	R*4	Variable	Contains parameters and other information
WORK	Input	R*4	Variable	Temporary work space used to hold data for printing multi-year average zone contents
MON	Input	R*4	12	Character array containing monthly name
I1	Input	I*4	1	Location of the first position in the PO array containing information specific to the current subarea
K	Input	I*4	1	Current subarea being printed

SUBROUTINE PLOTMY
 (PO, CO, IMONTH, KYR, MONTH, KWY, IOPT1, IOPT2, LASTYR, IAPI)

Function: Subroutine PLOTMY generates the multi-year and optional yearly water balance summary for the entire area.

Argument List:

<u>Variable</u>	<u>Input/Output</u>	<u>Type</u>	<u>Dimension</u>	<u>Description</u>
PO	Input	R*4	Variable	Contains parameters and other information
CO	Input	R*4	Variable	Array contains multi-year and yearly water balance data values
IMONTH	Input	I*4	1	First month of the current water year
KYR	Input	I*4	1	Current calendar year
MONTH	Input	I*4	1	Last month of the current water year
KWY	Input	I*4	1	Current water year
IOPT1	Input	I*4	1	Indicator if yearly water balance to be printed: 0 = no printed 1 = yes
IOPT2	Input	I*4	1	Indicator if multi-year zone contents display to be printed: 0 = no 1 = yes
LASRYR	Input	I*4	1	Indicator if list year: 0 = no 1 = yes
IAPI	Input	I*4	1	Indicator if API-CONT model is being used: 0 = no 1 = yes

SUBROUTINE TAB40 (TO,LEFT,IUSET,NXT,LPO,PO,LCO,TS,MTS,P,MP,NWORK,
LWORK,IDT)

Function: This is the Operations Table entry subroutine for
Operation WATERBAL.

Argument list: The arguments for this subroutine are similar to the
arguments for the operation table entry subroutines for other
operations. A description of the arguments is contained in section
VIII.4.2-TAB.

Operation Table Array: The contents of the TO array are:

<u>Position</u>	<u>Contents</u>
1	Operation number
2	Location of the next operation in the T array
3	Location of parameters in the P array
4	Location of carryover in the C array
5	Location of observed discharge in the D array
6	Location of simulated discharge in the D array
7	Location of working space
8-7+(4*NOSUB)	Locations of the following pointers: <ul style="list-style-type: none">- Snow model parameters for each subarea- Snow model carryover for each subarea- Rainfall/Runoff parameters for each subarea- Rainfall/Runoff carryover for each subarea 0 = model does not exist