

V.3.3-BASEFLOW BASEFLOW SIMULATION OPERATION

Identifier: BASEFLOW

Application: All programs

Description: This Operation enables the user to compute the baseflow contribution to the outflow hydrograph. Three options are included: constant baseflow, baseflow reduction at a constant rate, and baseflow reduction at a variable rate. Since this Operation stores baseflow as a time series, total discharge from a given area can be tabulated into component parts of discharge due to baseflow and discharge due to surface runoff. This Operation is primarily designed to be used with API based rainfall/runoff Operations. Currently, no provision is included to simulate baseflow recharge.

An indicator switch, set at initialization time, controls which baseflow option is to be used. A brief description of each option is as follows:

1. Constant baseflow: Baseflow does not change with time. A baseflow value is defined at initialization time and does not change unless the Operation has been re-initialized with a new constant baseflow value or either the CBASEF or the CBFRATE MOD's have been executed. To use this option, set the variable baseflow option indicator switch to 0 at initialization time.
2. Baseflow reduction at a constant rate: Baseflow contains a constant and variable component and the variable component decreases at a constant rate. The initial total baseflow, as well as constant baseflow and a daily baseflow recession coefficient, are specified at segment definition time. Then at run time, the variable portion is reduced by this daily recession factor for each day of the run. The baseflow reduction in any given day is prorated over each period of that day. Total baseflow may be changed at run time by using either the BASEF or BFRATE MOD. Changes made with both these MOD's are date/time specific. The CBASEF or CBFRATE MOD's are used to change the constant baseflow component. The baseflow recession coefficient may be changed at run time by using the BFRCHNG MOD. To use this option, set the variable baseflow option indicator switch to 1 at initialization time.
3. Baseflow reduction at a variable rate: Baseflow contains a constant and variable component, and the variable component decreases at a rate which can differ from day to day. Initial total and constant baseflow values, and an initial baseflow recession coefficient, are specified at segment definition time. Then at run time, the variable portion is reduced by the daily baseflow recession factor in effect for that particular day. The baseflow recession factor is changed at run time by the BFRCHNG MOD. The total baseflow value can be changed at run time by using either the BASEF or the BFRATE MOD. Changes

made with all these MOD's are date/time specific. The CBASEF or CBFRATE MOD's are used to change the constant baseflow component. To use this option, set the variable baseflow option indicator switch to 2 at initialization time.

Special provisions of this Operation include:

1. Parameters and carryover values entered into this Operation may be in either metric or English units. The metric/English switch, the first parameter entered at initialization time, specifies which units are to be used.
2. If the constant baseflow option is chosen (variable baseflow option indicator = 0), a constant baseflow value is entered by the user at initialization time. No carryover is stored by this Operation under this option.
3. If the constant rate baseflow recession option is chosen (variable baseflow option indicator = 1), a constant baseflow amount, a baseflow recession coefficient, and an initial 12Z total baseflow carryover value must be entered by the user at initialization time.
4. If the variable rate baseflow recession option is chosen (variable baseflow option indicator = 2) baseflow recession coefficients are stored as a time series. Therefore, a baseflow recession coefficient ID and a data type code must be entered by the user at initialization time, along with a constant baseflow amount, an initial 12Z total baseflow value and an initial baseflow recession coefficient.
5. Default carryover values are not assigned by this Operation. If initial carryover is required it must be entered by the user.

Allowable Data Time Intervals: 1, 2, 3, 4, 6, 8, 12 and 24 hours

Time Series Used: Time series used in this Operation are as follows:

<u>General Type</u>	<u>Dimn</u>	<u>Units</u>	<u>Use Required</u>	<u>Form of Output T.S.</u>	<u>Data Time Interval</u>	<u>Missing Values Allowed</u>	
Baseflow	L3/T	CMS	0	yes	replace	variable	no
Baseflow recession	DL	PCTD	I/O	no	update	24	yes

Input Summary: The card input for this Operation is as follows:

Card	Format	Columns	Contents
1	I1	1	Metric/English input units indicator: 0 = English 1 = Metric
	3X,2A4	5-12	Identifier of baseflow time series
	2X,A4	15-18	Data type code baseflow time series
	1X,I2	20-21	Data time interval baseflow time series (HR)
	3X,F9.0	25-33	Area associated with this Operation (MI2 or KM2)
	1X,F9.0	35-43	Constant baseflow amount (CFS or CMS)
	1X,I1	45	Variable baseflow option indicator: 0 = no variable baseflow 1 = constant baseflow recession coefficient 2 = recession coefficient supplied as a time series

If the variable baseflow option indicator is equal to zero, no additional input is needed to initialize this Operation. If the variable baseflow option indicator is equal to 1, cards 2a and 3a are needed. If the variable baseflow option indicator is equal to 2, cards 2b and 3b are needed.

2a	F5.3	1-5	Constant baseflow recession coefficient (must be ≥ 0.5 or < 1.0)
3a	F9.0	1-9	Initial total previous baseflow (CFS or CMS)
or			
2b	2A4	1-8	Identifier of baseflow recession coefficient time series
	1X,A4	10-13	Data type code baseflow recession coefficient time series
3b	F9.0	1-9	Initial total previous baseflow (CFS or CMS)
	5X,F5.3	15-19	Initial baseflow recession coefficient (must be ≥ 0.5 or < 1.0)

Sample Input and Output: Sample input is shown in Figure 1. Sample output from the parameter print routine is shown in Figure 2. There is no execution routine output.

Error and Warning Messages: The error and warning messages generated by this Operation and the corrective action to take when they occur are as follows:

1. ****ERROR**** THE METRIC/ENGLISH SWITCH MUST EQUAL 0 OR 1. THE VALUE ENTERED WAS XXXX.

Action: Correct metric/English switch and change Card 1.
2. ****ERROR**** AREA MUST EXCEED ZERO SQUARE (KILOMETERS OR MILES). THE VALUE ENTERED WAS XXXXXXXXXX.

Action: Correct area and change Card 1.
3. ****ERROR****CONSTANT BASEFLOW MUST BE GREATER THAN OR EQUAL TO ZERO (CMS OR CFS). THE VALUE ENTERED WAS XXXXXXXXXX.

Action: Correct the constant baseflow and change Card 1.
4. ****ERROR**** THE VARIABLE BASEFLOW OPTION INDICATOR MUST EQUAL ONE OF THE FOLLOWING VALUES: 0, 1, OR 2. THE VALUE ENTERED WAS XXXX.

Action: Correct the variable baseflow option indicator and change Card 1.
5. ****ERROR**** CONSTANT RECESSION COEFFICIENT FOR BASEFLOW MUST EQUAL A VALUE BETWEEN 0.50 AND 0.999 INCLUSIVELY. THE VALUE ENTERED WAS XXX.

Action: Correct the constant baseflow recession coefficient and change Card 2a.
6. ****ERROR**** STANDARD UNITS OF THE RECESSION COEFFICIENT DATA TYPE MUST BE PCTD. DATA TYPE XXXX HAS UNITS OF XXXX.

Action: Correct the baseflow recession coefficient time series data type code and change Card 2.
7. ****ERROR****BASEFLOW RECESSION COEFFICIENT LIMITS ARE 0.5 AND 0.999 INCLUSIVELY. THE VALUE ENTERED WAS XXXX.

Action: Correct the baseflow recession coefficient and change Card 3b.
8. ****WARNING**** TOTAL PREVIOUS BASEFLOW MUST EQUAL OR EXCEED THE CONSTANT BASEFLOW OF XXXX. (CFS OR CMS). THE TOTAL PREVIOUS BASEFLOW VALUE ENTERED WAS XXXX. (CMS OR CFS). TOTAL PREVIOUS BASEFLOW WAS SET EQUAL TO CONSTANT BASEFLOW BEFORE BEING STORED AS CARRYOVER.

Action: Check if default action is okay. If not, change total baseflow or the constant baseflow amount.

Carryover Transfer Rules: During the carryover transfer process for

this Operation, the following checks are made to see if the variable baseflow option indicator has changed:

1. If the variable baseflow option indicator does not change, the old carryover values are transferred into the new carryover array without any changes.
2. If the variable baseflow option indicator goes from 1 to 2 (constant baseflow recession coefficient to a variable baseflow recession coefficient), 12Z total baseflow is transferred from the old to the new carryover array. The baseflow recession coefficient entered by the user is used.
3. If the variable baseflow option indicator goes from 2 to 1 (variable baseflow recession coefficient to a constant baseflow recession coefficient), 12Z total baseflow is transferred from the old to the new carryover array.
4. For all other combination of changes between the old and the new variable baseflow option indicator, no transfer of carryover takes place.

Punched Card Rules: When punching input cards for this Operation, the following rules are applicable:

1. The format of punched cards is identical to those described in the Input Card Summary of this documentation, except that F9.0 fields are punched as F9.2.
2. No checks are made for the validity of the parametric or carryover data during the punching process.
3. No default carryover values are assigned during the punching process.

Figure 1. Sample Card Input For Operation BASEFLOW

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          - Column -
      5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
BASEFLOW      AFTNC
0  AFTNCBF    SQIN  6      395.00      0.0  2
AFTNC      BFR
      200.      0.990
  
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Figure 2. Sample Output From Operation BASEFLOW Print Parameter Routine

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*****
BASEFLOW OPERATION      NAME=AFTNC      PREVIOUS NAME=
*****
  
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PARAMETRIC DATA FOR THE BASEFLOW SIMULATION OPERATION:

BASEFLOW ID	TIME SERIES TYPE	INFORMATION DELTA-T (HOURS)	AREA (MI**2)	CONSTANT BASEFLOW (CFS)	VARIABLE BASEFLOW
AFTNCBF	SQIN	6	395.0	0.0	YES

BASEFLOW RECESSON COEFF TIME SERIES INFORMATION:

ID	TYPE	DELTA-T (HOURS)
AFTNC	BFR	24

CARRYOVER DATA FOR THE BASEFLOW SIMULATION OPERATION:

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PREVIOUS TOTAL BASEFLOW =      200.0 CFS
BASEFLOW RECESSON COEFFICIENT = 0.990
  
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