V.3.3-GLACIER   GLACIER ROUTING OPERATION

Identifier: GLACIER

Application: All programs

Description: This Operation uses a routing model developed by R. D. Moore (1993) to route runoff through a glacial system.

The intended use of this model is to input the rain+melt time series from Snow-17 and output a modified rain+melt time series which accounts for glacial storage. The model uses a logistic function to simulate storage early in the melt season and depletion late in the melt season. Parametric input consists of two glacial routing parameters, a minimum and maximum glacial outflow coefficient and an antecedent flow index decay parameter.

Reference: Moore, R.D., 1993, Application of a Conceptual Streamflow Model in a Glacierized Drainage Basin, Journal of Hydrology, 150:151-168

Developed By: Alaska River Forecast Center

Allowable Data Time Intervals: 6, 12 and 24 hours

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

General Type	Dimn	Units	Use	Required	Form of Output T.S.	Data Time Interval	Missing Values Allowed
Rain+melt	L	MM	I	yes	n/a	any	no
Glacier output	L	MM	O	yes	n/a	any	no
AFAI output	L	MM	O	no	n/a	any	no

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

Card	Format	Columns	Contents
1	2X,2A4	3-10	Identifier of rain+melt time series
	1X,A4	12-15	Data type code of rain+melt time series
	3X,I2	19-20	Data time interval of rain+melt and output time series

Card	Format	Columns	Contents
	2X,2A4	23-30	Identifier of glacier output time series 1/
	1X,A4	32-35	Data type code of glacier output time series
	2X,2A4	38-45	Identifier of Antecedent Flow Index Function output time series 2/
	1X,A4	47-50	Data type code of Antecedent Flow Index Function time series
2	2X,F5.1	3-7	CG1 parameter
	2X,F4.2	10-14	CG2 parameter
	2X,F4.2	16-20	AFI decay parameter
	2X,F4.2	23-26	KG1 parameter
	2X,F4.2	29-32	KG2 parameter
3	2X,F6.1	3-8	Initial glacier storage
	2X,F6.1	11-16	Initial AFI decay parameter

Notes:

1/ The glacier output time series is the amount of water coming out of the glacier and is input into the UHG Operation.

2/ The Antecedent Flow Index Function is an index function that describes the outflow rate between a maximum and minimum value (KG1 AND KG2). The values are output to help in model calibration and to check operationally during significant outflow periods.

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. MAX OUTFLOW COEF MUST BE GREATER THAN OR EQUAL TO MIN COEF

     Action: Select valid values and reenter.

  2. THE AFI DECAY PARAMETER MUST BE GREATER THAN OR EQUAL TO ZERO
     AND LESS THAN OR EQUAL TO ONE

     Action: Select valid value and reenter.

3. OUTFLOW COEFS MUST BE GREATER THAN OR EQUAL TO ZERO AND LESS
   THAN OR EQUAL TO ONE

   Action: Select valid values and reenter

4. ANTECEDENT FLOW INDEX CANNOT BE LESS THAN ZERO

   Action: Select valid value and reenter.

5. STORAGE CANNOT BE LESS THAN ZERO

   Action: Select valid value and reenter.

Carryover Transfer Rules: During the carryover transfer process no
checks are made as to whether the values fall within valid ranges.

Punched Card Rules: The format of the punched cards is identical to
those described in the input summary of this document.

Figure 1. Sample card input for Operation GLACIER


```
                              - Column -
     5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+

GLACIER    MPTA2GL
  MPTA2GL  RAIM    6  MPTA2GL  GOUT  FAFIMPTA AFAI
  -6.0  0.01  0.95  0.05  0.20
    38.9    50.7
```


Figure 2. Sample output from Operation GLACIER print parameter
              routine


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 ********************

 GLACIER  OPERATION     NAME=MPTA2GL     PREVIOUS NAME=

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         GLACIER OPERATION FROM MOORE(1993)

        TIME SERIES USED

          RAIN+MELT          MPTA2GL    RAIM      6 HOURS

          GLACIER OUT        MPTA2GL    GOUT      6 HOURS

          AFAI OUT           FAFIMPTA   AFAI      6 HOURS

          CG1    -6.0  CG2  0.01  CG3  0.95  KG1  0.05  KG2  0.20

          PREVIOUS STORAGE=   38.9

          PREVIOUS AFI=   50.7
```