V.3.3-LAY-COEF   LAYERED COEFFICIENT ROUTING OPERATION

Identifier: LAY-COEF

Application: All programs

Description: This Operation attenuates discharge through a reach
much like a decay function by applying different routing coefficients
to different levels of flow or layers. Since Layered Coefficient
routing has the ability to variably attenuate flow in a reach because
of different coefficients for different flow layers, the method can
be used at a point to account for attenuation in a channel system
above a headwater gage.

A complete description this Operation is in Chapter II.4-LAY-COEF.

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

Time Series Used:

General Type	Dimn	Units	Use	Required	Form of Output T.S.	Data Time Interval	Missing Values Allowed
Channel inflow	L3/T	CMS	I	yes	n/a	any	no
Channel outflow	L3/T	CMS	O	yes 1/	additive	2/	yes

1/ Output time series not required if routing is performed at a
   point.

2/ Must be greater than or equal to data time interval of the inflow
   time series.

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

Card	Format	Columns	Contents
1	5A4	1-20	General information for this Operation
	2X,2A4	23-30	Internal identifier for the inflow time series
	1X,A4	32-35	Data type code for the inflow time series
	3X,I2	39-40	Time interval for inflow time series
	2X,2A4	43-50	Internal identifier for outflow time series (blank if routing at a point)

Card	Format	Columns	Contents
	1X,A4	52-55	Data type code for outflow time series (blank if routing at a point)
	3X,I2	59-60	Time interval for outflow time series (blank if routing at a point)
	2X,I3	63-65	Number of layers
	4X,I1	70	Carryover control indicator: 0 = all carryover set to zero by default 1 = carryover read from data cards
2	7F10.0	1-70	Coefficients for layered coefficient routing beginning with the bottom layer. If there are more than seven layers the succeeding data cards are read until all coefficients are input.
3	7F10.0	1-70	Upper limit of flow for each layer beginning with the bottom layer. There is no upper limit for the top layer. If there is only one layer this card is not needed.

Next card only needed if carryover is to be read from data cards.

Card	Format	Columns	Contents
4	7F10.0	1-70	Initial carryover for each layer beginning with the bottom layer

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

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

A. Messages that can occur during setup.

  1. **ERROR** OUTFLOW TIME INTERVAL = XX IS LESS THAN INFLOW TIME INTERVAL = XX THIS IS NOT ALLOWED FOR THIS OPERATION

     Action: Use an outflow time interval that is greater than or equal to the inflow time interval.

  2. **ERROR** FLOW RANGES FOR LAYERS ARE NOT IN INCREASING ORDER.

     Action: Put maximum flows for each layer in increasing order.

3. **WARNING**XX COEFFICIENTS HAD VALUES GREATER THAN 1.
   VALUES WERE SET EQUAL TO 1.

   Action: Check coefficents and make sure that none are
   greater than 1.

4. **ERROR** THE NUMBER OF COEFFICIENTS IS ZERO

   Action: Check input data to insure that the number of
   coefficients and layers is not zero.

B. Messages that occur during execution: None

Carryover Transfer Rules: The old carryover for a layer, Rold (I),
is divided proportionally into the respective new layers. The new
carryover is then adjusted to account for changes in coefficients by:

   $Rn (I) = Ro (I) (1.- Cn(I))/(1. - Co (I))$

   where Rn is the new carryover

          Ro is the old carryover

          Cn is the new routing coefficient

          Co is the old routing coefficient

The carryover transfer process is not an exact relationship. It
could take 3 or 4 time intervals after carryover transfer is
performed before the effects of the change in parameters can no
longer be noticed.

Punch Card Limitations: The punch card format is as follows. No
checks were made to determine if quantities exceed the maximum
allowable value.

Parameters or Variables	Punch Format	Maximum Value	Precision After Decimal Point
Coefficients	F10.4	99999.9999	ten-thousandths
Flow Limits	F10.4	99999.9999	ten-thousandths
Carryover	F10.4	99999.9999	ten-thousandths

Figure 1. Sample Card Input For Operation LAY-COEF

```
                                   - Column -
      5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
   ----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
   WEHNE TO FORT WAYNE    WEHNE    QINE    6  WEHFTW    SQIN    6    3
         0.9        0.50         0.80
        300.0     1100.0
```

Figure 2. Sample Output From Operation LAY-COEF Print Parameter And
          Print Carryover Routines

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        LAYERED COEFFICIENT ROUTING FOR REACH WEHNE TO FORT WAYNE

        COMPUTATIONAL TIME INTERVAL IS   6 HOURS

        NUMBER OF LAYERS  3

                TIME SERIES USED BY THIS OPERATION

            CONTENTS                I.D.        TYPE     TIME INTERVAL

            INFLOW                 WEHNE       QINE      6 HOURS

            OUTFLOW                WEHFTW      SQIN      6 HOURS

            COEFFICIENT            RANGE (CMS)

             .9000         Q LESS THAN      300.000

             .5000            300.000  TO  1100.000

             .8000         Q GREATER THAN  1100.000

        INITIAL CARRYOVER VALUES SET TO ZERO BY DEFAULT
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