V.3.3-CHANLOSS CHANNEL LOSS OPERATION

Identifier: CHANLOSS

Application: All programs

Description: This Operation accounts for losses or gains of water that occur along a channel reach as a result of flow through the channel bottom and evaporation from the stream surface.

Even though channel losses are actually distributed along the length of the reach the Operation adjusts instantaneous discharges at a flow point for such losses.

Parameter SSOUT specifies the sub-surface loss and is defined as the rate in CMS of sub-surface outflow along the stream channel. A positive SSOUT value indicates a loss of water from the stream and a negative value indicates a gain of water by the stream. SSOUT can be constant throughout the year or it can vary from month to month. Constant SSOUT is defined with one value. Variable SSOUT is defined by twelve values at the 16th of each month. When variable SSOUT is used daily values are obtained through linear interpolation between mid-month values. The computational data time interval for the Operation is equal to the data time interval of the instantaneous discharge data.

SSOUT is applied to each drainage value as follows:

$$Q = Q - SSOUT \quad (1)$$

where both Q and SSOUT are discharge rates in CMS

If SSOUT is greater than Q then Q is set to 0.0 to avoid negative flow values.

Since channel bottom losses generally increase with discharge, SSOUT may also be specified as a percentage of the discharge rate. The percentage can be constant or it can vary from month to month. When a variable percentage is used, twelve 16th of the month percentages (percent/100) are defined and the daily values are obtained through linear interpolation between the mid-month values. When defined as a percentage SSOUT is applied as follows:

$$Q = Q - SSOUT*Q \quad (2)$$

where Qis the discharge rate in CMS and SSOUT is a decimal fraction

The second step in the loss Operation is to account for evaporation from the water surface area (Aw) of the stream. This step is performed only when Aw in KM2 is assigned a value greater than 0.0. Daily evaporation data can be obtained from either of two sources:

- o a computed day-by-day potential evaporation (PE) record can be generated from daily data, synoptic data or pan data

- o long-term average evaporation (Ea) curve

Daily evaporation data in MM per day are converted to evaporation rates in MM for each data time interval (TIMINT) hours by a daily distribution factor (DIST). The distribution can be uniform throughout the day or it can have a fixed diurnal variation. A diurnal effect is not very pronounced over water because of the heat storage capacity of water. Also the effect of the diurnal variation in evaporation over a reach does not typically show up when examining a single flow point. It is recommended that the uniform distribution be used in most cases. If a diurnal variation is selected then the values that are used are as follows:

Hour (local time)	Portion of ET-demand
1-8	0.00
9	.02
10	.02
11	.10
12	.16
13	.20
14	.18
15	.14
16	.09
17	.05
18	.01
19-24	0.00

This table represents the fixed diurnal variation for evaporation, expressed as percent/100 of daily evaporation, that is applied each hour.

When PE data are used the daily PE values can be adjusted with a constant adjustment factor (PEADJ) and with a varying seasonal adjustment factor (EMO). EMO is defined from a set of twelve values corresponding to the desired adjustment for the 16th of each month. Linear interpolation between these values provides an EMO value for each day of the year. Evaporation (E) in MM per TIMINT hours is determined as:

$$E = PE * PEADJ * DIST * EMO \quad (3)$$

When Ea data are used, daily Ea values are derived from an average evaporation curve. The curve is defined at twelve points which reflect Ea in MM per day for the 16th of each month. Daily Ea values are obtained by linear interpolation between mid-month values. A constant adjustment can be made with PEADJ. A seasonal adjustment is built into the Ea curve. Evaporation in MM per TIMINT hours is computed by:

$$E = Ea * PEADJ * DIST \quad (4)$$

Evaporation in MM per TIMINT hours must be converted to an instantaneous loss rate (ELOSS) in CMS for the channel reach or:

ELOSS = E * 0.27778/TIMINT * Aw

where 0.27778 is a conversion factor. The instantaneous discharge rate is then adjusted for evaporation loss as follows:

Q = Q - ELOSS (5)

Since negative discharges are not permitted, Q is set to 0.0 if ELOSS is greater than Q.

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:

General Type	Dimn	Units	Use	Required	Form of Output T.S.	Data Time Interval	Missing Values Allowed
Instantaneous discharge	L3/T	CMS	I/O	yes	replaces	any	no
Potential evaporation	L	MM	I	no	n/a	24	no

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

Card	Format	Columns	Contents
1	5A4	1-20	General name for the point where the Operation is applied
	1X,A4	22-25	Type of SSOUT used: 'VARC' = variable SSOUT (units of CMS) 'VARP' = variable SSOUT (units of percentage) 'FIXP' = constant SSOUT (units of percentage) default = constant SSOUT (units of CMS)
	5X,F10.2	31-40	Constant SSOUT loss parameter in CMS or a decimal fraction if expressed as a percentage; if SSOUT is variable then leave blank; a negative sign must accompany value or percentage to get a gain instead of a loss
	5X,F10.1	46-55	Water surface area of channel system in KM2; an evaporation loss is applied only if this value is greater than 0.0

Next entry needed only if water surface area is greater than 0.0.

	1X,A4	57-60	PE time series availability: 'NOPE' = no PE time series default = PE time series used
2	2A4	1-8	Internal identifier for discharge time series
	3X,A4	12-15	Data type code for discharge time series
	I5	16-20	Data time interval for discharge time series (this is the computation time interval for the Operation)

Next 3 entries needed only if PE time series used.

	5X,2A4	26-33	Internal identifier for PE time series
	3X,A4	37-40	Data type code for PE time series
	I5	41-45	Data time interval for PE time series (must be daily values)

Next card is necessary only if variable SSOUT is used.

3	6F10.2	1-60	Variable SSOUT values (either in percent/100 or CMS) for the 16th of each month (January through December)

Next 2 cards necessary only if water surface area is greater than 0.0.

4	F5.2	1-5	Constant evaporation adjustment factor (PEADJ)
	6X,A4	12-15	Type of daily evaporation distribution: 'DIUR' = diurnal default = uniform
5	12F5.3	1-60	Long-term average evaporation values (Ea) or seasonal adjustment factors (EMO) on the 16th of each month (January through December); if PE time series used then values represent EMO; otherwise the values are Ea in MM/day

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.

Figure 1. Sample card input for Operation CHANLOSS

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                                        - Column -
    5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+
CHANLOSS    PDASW
IRRIGATION LOSSES    VARC                              0.0
PDASW       SQIN    6
      0.00      0.00      0.70      1.50      2.00      3.00
      3.00      1.50      0.50      0.50      0.00      0.00
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Figure 2. Sample output from Operation CHANLOSS print parameter routine

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 CHANLOSS OPERATION     NAME=PDASW        PREVIOUS NAME=

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          CHANNEL LOSS OPERATION -- LOSS(OR GAIN) OF WATER IN THE CHANNEL ABOVE
                                    IRRIGATION LOSSES    AS A RESULT OF FLOW THROUGH THE WETTED
                                     PERIMETER AND/OR EVAPORATION FROM THE WATER SURFACE

          TIME SERIES USED:         ID                TYPE              TIME(HR)
                                    PDASW             SQIN               6

          COMPUTATIONAL TIME INTERVAL FOR THE OPERATION =  6 HOURS.

          CHANNEL BOTTOM LOSS PARAMETER (SSOUT) IS VARIABLE.
                             VARIABLE SSOUT VALUES FOR THE 16TH OF EACH MONTH
                               1      2      3      4      5      6      7      8      9     10     11     12
        SSOUT LOSS IN CMS     0.0    0.0    0.7    1.5    2.0    3.0    3.0    1.5    0.5    0.5    0.0    0.0

               NOTE: NEGATIVE SSOUT INDICATES A GAIN INSTEAD OF A LOSS.

          WATER SURFACE AREA (WSAREA) = 0.00. NO EVAPORATION LOSS IS COMPUTED.
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