

V.3.3-ASSIM END OF OPERATIONS TO BE RE-EXECUTED BY ASSIMILATOR OPERATION

Identifier: ASSIM

Application: Operational Forecast System programs only

Description: This Operation is a soil moisture updating model which modifies current soil moisture states.

The Operation uses the iterative Rosenbrock Optimization Technique to estimate the current <optimal' soil moisture states. Initial soil moisture states and input precipitation are varied over the run period and an objective function that includes the difference between observed and simulated flows, precipitation adjustments and state adjustments is minimized.

Operation BEGASSIM marks the beginning of the section of the Operations Table that must be re-executed and Operation ASSIM marks the end of the section of the Operations Table that must be re-executed.

See Chapter II.3-ASSIM for a complete description of the model.

Developed By: Riverside Technology, Inc.

Allowable Data Time Intervals: 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</u>	<u>Required</u>	<u>Form of Output T.S.</u>	<u>Data Time Interval</u>	<u>Missing Values Allowed</u>
QME	L3	CMSD	I	yes	n/a	24	yes
SQME	L3	CMSD	I	yes	n/a	24	no
KP	DLES	CMSD	I/O	yes	replaces	24	yes

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

<u>Card</u>	<u>Format</u>	<u>Columns</u>	<u>Contents</u>
1	5A4	1-20	General user supplied heading information
	2X,2A4	21-30	Assimilator parameter identifier

<u>Card</u>	<u>Format</u>	<u>Columns</u>	<u>Contents</u>
	1X,I2	31-33	Number of sub areas within basin
	2X,I2	34-37	Number of days per discharge interval
	1X,I2	38-40	Number of days per precipitation interval
	3X,F4.2	41-47	Weight coefficient for discharge
	1X,F4.2	48-52	Weight coefficient for precipitation
	1X,F4.2	53-57	Weight coefficient for states
2	2A4	1-8	Observed discharge time series identifier
	1X,A4	9-13	Observed discharge data type
	9X,2A4	14-30	Simulated discharge time series identifier
	1X,A4	31-35	Simulated discharge data type
	1X,I4	36-40	Maximum number of iterations for optimizer
	1X,F8.6	41-49	Delta value for optimizer
	1X,F4.2	50-54	Minimum criteria value for optimizer
3	2A4	1-8	Rainfall/runoff operation type (only SAC-SMA currently allowed)
	1X,2A4	9-17	Rainfall/runoff operation identifier
	1X,2A4	18-26	Kp time series identifier
	1X,F4.2	27-31	Precipitation weight for the basin
	1X,F4.2	32-36	State weight for the basin
	1X,F4.2	37-41	Kp minimum value
	1X,F4.2	42-46	Kp maximum value
	1X,I2	47-49	State option
4	F4.2	1-4	Ks minimum value
	1X,F4.2	5-9	Ks maximum value
	1X,I1	10-11	State on/off switch 1
	1X,I1	12-13	State on/off switch 2

<u>Card</u>	<u>Format</u>	<u>Columns</u>	<u>Contents</u>
	1X,I1	14-15	State on/off switch 3
	1X,I1	16-17	State on/off switch 4
	1X,I1	18-19	State on/off switch 5
	1X,I1	20-21	State on/off switch 6

Repeat cards 3 and 4 for each sub-basin.

Sample Input and Output: Sample input is shown in Figure 1. Sample output from the parameter print routine is shown in Figure 2. Sample output from the execution routine is show in Figure 3.

Figure 1. Sample Card Input For Operation ASSIM

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- Column -
  5   10  15  20  25  30  35  40  45  50  55  60  65  70  75  80
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
ASSIM
51010 AREA                AREA1234  2  2  4  8.00 2.00 1.25
AREAL  QME                51010    SQME 1000 0.000001 0.0001
SAC-SMA 51010            51010    0.50 1.00 0.75 1.25 1
0.65 1.35 1 1 1 1 1 1
SAC-SMA 51010LO         51010LO  0.50 1.00 0.75 1.25 1
0.65 1.35 1 1 1 1 1 1

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Figure 2. Sample Output From Operation ASSIM Print Parameter Routine

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ASSIMILATION OPERATION INFO
51010 AREA
NUMBER OF SUB-BASINS
2
OPTIMIZATION PARAMETERS
MAX NUMBER OF ITERATIONS 50
DELTA VALUE .000001
MINIMUM CRITERIA VALUE .00001
WEIGHTS OF OPTIMIZATION MULTIPLIERS
DISCHARGE 8.00
STATE VARIABLES 2.00
PRECIPITATION 1.25
DISCHARGE TIME SERIES
OBSERVED
TS ID TYPE
AREAL QME
SIMULATED
TS ID TYPE
51010 SQME
# | RAINFALL/RUNOFF | | BASIN WEIGHTS | STATE | KP | KP | KS | KS | STATES ON/OFF SWITCHES
| OPER TS ID | | PRECIP | STATES | OPTION | MIN | MAX | MIN | MAX |
-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1 | SAC-SMA 51010 | | 51010 | .50 1.00 | 1 | .75 | 1.25 | .65 | 1.35 | 1 1 1 1 1 1
2 | SAC-SMA 51010LO | | 51010LO | .50 1.00 | 1 | .75 | 1.25 | .65 | 1.35 | 1 1 1 1 1 1

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Figure 3. Sample Output From Operation ASSIM Execution Routine

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ASSIMILATOR OPTIONS
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OPTIMIZATION RUN

ADJUSTING PRECIPITATION AND STATES IN RUN

PRECIPITATION SENSITIVITY ANALYSIS OFF

SETTING INITIAL KP VALUES TO 1

BEFORE ASSIMILATOR RUN
OBJECTIVE VALUE 3.246897   DISCHARGE CONTRIBUTION 3.246897   PRECIPITATION CONTRIBUTION .000000   STATES CONTRIBUTION
.000000

AFTER ASSIMILATOR RUN
OBJECTIVE VALUE 3.152776   DISCHARGE CONTRIBUTION 2.685857   PRECIPITATION CONTRIBUTION .466840   STATES CONTRIBUTION
.000079

ASSIMILATOR PARAMETRIC ID AREA1234
NUMBER OF SUB BASINS 2
NUMBER OF DAYS PER DISCHARGE PERIOD 2
NUMBER OF DAYS PER PRECIPITATION PERIOD 4

OPTIMIZER STOPPING CRITERIA
MAXIMUM NUMBER OF ITERATIONS 50
MINIMUM PERCENTAGE OF CHANGE IN OBJECTIVE FUNCTION .000001
MINIMUM CRITERIA VALUE .0001

GENERAL WEIGHTS
WQ WEIGHT 8.00
WP WEIGHT 2.00
WS WEIGHT 1.25

BASIN WEIGHTS AFTER NORMALIZATION

BASIN | WP_B AFTER NORMALIZATION | WS_B AFTER NORMALIZATION |
-----|-----|-----|
1 | .50 | .50 |
2 | .50 | .50 |

KP AND KS INFORMATION FOR EACH BASIN

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BASIN # 1

KS AFTER RUN 1.00

PERIOD | 1 | 2 | 3 | 4 | 5 | 6 |
-----|-----|-----|-----|-----|-----|
KP BEFORE RUN | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
-----|-----|-----|-----|-----|-----|
KP AFTER RUN | .99 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
-----|-----|-----|-----|-----|-----|

BASIN # 2

KS AFTER RUN 1.00

PERIOD | 1 | 2 | 3 | 4 | 5 | 6 |
-----|-----|-----|-----|-----|-----|
KP BEFORE RUN | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
-----|-----|-----|-----|-----|-----|
KP AFTER RUN | 1.00 | 1.25 | 1.25 | 1.06 | .75 | .75 |
-----|-----|-----|-----|-----|-----|

```