

V.3.3-API-SLC SALT LAKE CITY (CBRFC) API-RUNOFF OPERATION

Identifier: API-SLC

Application: All Programs

Description: This Operation calculates Antecedent Precipitation Indices (API) and runoff amounts for a defined basin.

It uses the coaxial correlation method of computing rainfall excess or runoff. API values are daily and runoff amounts are 6 hourly. Input data are basin rainfall/melt and percent areal snow cover.

See Chapter II.3-API-SLC for a detailed description of the Operation.

Special provisions of this Operation include:

1. The minimum period for which the Operation can be executed is 1 day. Operationally the day ends at 12Z.
2. The data time interval for rainfall/melt and runoff for this Operation is fixed at 6 hours.
3. Initial carryover values may be specified by the user for a basin during set up. These values include the current API values, percent areal snow cover, storm flag and duration. If default carryover values are used, API is set to the lower limit; present areal snow cover, storm flag and duration are all set to zero.
4. An option is available for adjusting the API recession based on the simulated percent areal snow cover. It is assumed that no soil moisture loss occurs during periods of total basin snow cover, thus the API recession constant is set to 1.0 allowing no reduction in the API value. The input values of percent areal snow cover are daily values.
5. The option is available to allow the user to request output time series containing daily API values.
6. The API lower limit can be varied for each basin during setup time. The range is -.99 to 0.0 inches. This modification takes into account long severe dry periods in Arizona.
7. An option to change the significant level of precipitation is present (used to determine duration). The default is 0.10 inches but can range between 0.01 and 2.0 inches.
8. This Operation is the same procedure used at the West Gulf (Fort Worth) River Forecast Center (WGRFC) except for some minor modifications. By selecting the API lower limit as zero and not using the percent areal snow cover this Operation would be the same as the WGRFC procedure.

Developed by: Colorado Basin River Forecast Center

Allowable Data Time Intervals: 6 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>
Rainfall/melt	L	MM	I	yes	n/a	6	no
Runoff	L	MM	I	yes	n/a	6	no
API	L	MM	O	no	replaces	24	no
Percent snow cover	DLES	PCTD	I	no	n/a	24	no

Input Card Summary: Input cards required for the Operation are as follows:

<u>Card</u>	<u>Format</u>	<u>Columns</u>	<u>Contents</u>
1	6A4	1-24	Area name
	1X,F5.2	26-30	API recession constant; range 0.01 to .99; default is 0.9
	F5.2	31-35	API lower limit (units of IN); range .99 to 0.0
	F5.2	36-40	Significant precipitation level (units of IN); range 0.01 to 2.0; default is 0.1
	I5	41-45	Indicator if to read initial carryover values: 0 = no - do not read 1 = yes - read from Card 6
	I5	46-50	Indicator if to read output API time series information: 0 = no - do not read 1 = yes - read from Card 4
	I5	51-55	Indicator if to read percent snow cover time series information: 0 = no - do not read 1 = yes - read from Card 3
2	I5	1-5	Data time interval of rainfall/melt

<u>Card</u>	<u>Format</u>	<u>Columns</u>	<u>Contents</u>
			(units of HR); must be 6
	5X,2A4	11-18	Internal identifier of rainfall/melt time series
	3X,A4	22-25	Data type code of rainfall/melt time series
	I5	26-30	Data time interval of runoff time series (units of HR); must be 6
	5X,2A4	36-43	Internal identifier of runoff time series
	3X,A4	47-50	Data type code of runoff time series

Card 3 is needed if percent snow cover time series information is to be read. Column 55 of Card 1 must be set to 1 for this card to be read.

3	I5	1-5	Data time interval of percent snow cover time rainfall/melt (units of HR); must be 24
	5X, 2A4	11-18	Internal identifier of snow cover time series
	3X, A4	22-25	Data type code of snow cover time series

Card 4 is needed if output API time series information is to be read. Column 50 of Card 1 must be set to 1 for this card to be read.

4	I5	1-5	Data time interval of API time series (units of HR); must be 24
	5X,2A4	11-18	Internal identifier of API time series
	3X,A4	22-25	Data type code of API time series

Card 5 contains the API constants:

5	F5.2	1-5	A; intercept of WN on the RI1 axis of the API relationship; range .01 to 10.0
	F5.2	6-10	I; intercept of WX on the RI1 axis of the API relationship; range .01 to 10.0
	I5	11-15	WN; wettest week of year; range 1 to 52
	I5	16-20	WX; driest week of year; range 1 to 52
	F5.2	21-25	E1; curvature constant for WN; range 0.0

<u>Card</u>	<u>Format</u>	<u>Columns</u>	<u>Contents</u>
			to 1.0
	F5.2	26-30	E2; curvature constant for WX; range 0.0 to 1.0
	F5.2	31-35	CP; modifier to sine wave of the week of year relation; range 0.0 to 5.0
	F5.2	36-40	K constant for duration curves; range .01 to .99
	F5.2	41-45	M constant for duration curves; range 0.0 to 100.0
	F5.2	46-50	POW constant fur duration curves; range 0.0 to 5.0

Card 6 is needed if initial carryover values are to be read.
Column 45 of Card 1 must set to 1 for this card to be read.

6	F5.2	1-5	Current API values (units of IN); range API lower limit to 5.0
	F5.2	5-10	Current percent areal snow cover; range 0.0 to 1.0
	I5	11-15	Storm flag; range 0 to 4; zero for no storm in progress; 1-4 for the last period in which significant precipitation occurred during the previous day
	I5	16-20	Storm duration to date (units of HR); program will store in nearest 6 hour increments

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 measures to take when they occur are as follows:

Warnings

1. ****WARNING**** API CARRYOVER IS OUTSIDE OF LIMITS: -0.30
VALUE IS SET TO 0.0

Action: No action is required, unless you require a value other than the API lower limit or 5.0.

2. ****WARNING**** % SNOW COVER CARRYOVER IS OUTSIDE OF LIMITS: 120%

VALUE SET TO 0.0

Action: None

- 3. ****WARNING**** STORM FLAG OR DURATION WAS NEGATIVE STORM
FLAG: -1
DURATION: 0
BOTH VALUES ARE SET TO ZERO

Action: None

- 4. ****WARNING**** STORM FLAG AND DURATION BOTH MUST BE GREATER THAN
ZERO OR BOTH MUST BE EQUAL TO ZERO
STORM FLAG: 1 DURATION: 0
VALUES ARE SET TO ZERO

Action: None

Errors

- 1. ****ERROR****
ILLEGAL API RECESSION CONSTANT: -1.20
VALUES MUST BE GREATER THAN 0.0 AND LESS THAN 1.0
IF VALUE IS 0.0, CONSTANT IS SET TO DEFAULT OF 0.9

Action: Select valid recession constant and reenter.

- 2. ****ERROR****
ILLEGAL API LOWER LIMIT: -1.00
VALUES RANGE FROM -0.99 TO 0.0
DEFAULT IS 0.0

Action: Select valid lower limit and reenter.

- 3. ****ERROR****
ILLEGAL API CONSTANTS
ONE OF THE FOLLOWING PARAMETERS DOES NOT FALL WITHIN
PROGRAM LIMITS:

<u>ITEM</u>	<u>LIMITS</u>	<u>VALUE ENTERED</u>
A	.01 thru 10.0	3.00
J	.01 thru 10.0	4.30
WN	1 thru 52	5
WX	1 thru 52	33
E1	0.0 thru 1.0	1.40
E2	0.0 thru 1.0	5.90
CP	0.0 thru 5.0	2.90
K	.01 thru 0.99	0.0
M	0.0 thru 100.	0.0
POW	0.0 thru 5.0	2.0

Action: Determine which constant is bad and reenter. More than one value may be wrong.

- 4. ****ERROR****
ILLEGAL TIME INTERVAL FOR ONE OF THE FOLLOWING TIME SERIES:

RAINFALL/MELT INTERVAL IS (6) SHOULD BE 6 HOURS
RUNOFF INTERVAL IS (24) SHOULD BE 6 HOURS

Action: Determine which time interval is bad and reenter.

5. **ERROR**

ILLEGAL SIGNIFICANT PRECIPITATION LEVEL: 5.00
VALUES RANGE FROM .01 TO 2.0
DEFAULT IS 0.10

Action: Select valid level and reenter.

Carryover Transfer Rules: The following rules are used during the carryover transfer process for this Operation:

1. No checks for the validity of the parametric data are made during the transfer process.
2. A check of the new API carryover is made to see if it falls within the range of valid API values.

Punched Card Rules: The punched card rules for this Operation are as follows:

1. The format of punched cards is identical to those described in the Input Summary of this documentation.
2. No checks for the validity of data is made.

Figure 1. Sample card input for Operation API-SLC

```

- Column -
5  10  15  20  25  30  35  40  45  50  55  60  65  70  75  80
-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
API-SLC      TAOSW
TEXORADO-TAOS LOCAL      0.90-0.99 0.10      1      1      0
  6      TAOSW      MAP      6      TAOSW      INFW
 24      TAOSW      APIS
3.00 5.50  15  45 0.75 0.85 2.00 0.60  3.0  2.0
0.30 0.0  0  0

```

Figure 2. Sample output from Operation API-SLC print parameter routine

```

*****
API-SLC OPERATION      NAME=TAOSW      PREVIOUS NAME=
*****

AREA NAME: TEXORADO-TAOS LOCAL      OPERATION VERSION: 1      API LOWER LIMIT: -0.99
C/O INPUT FLAG: 1      API REC CONSTANT: 0.90
SIG. PRECIP VALUE: 0.10

TIME SERIES USED FOR THIS OPERATION

CONTENTS      TS I.D.      TYPE      TIME INTERVAL
-----
RAINFALL/MELT      TAOSW      MAP      6 HOURS
RUNOFF      TAOSW      INFW      6 HOURS
API      TAOSW      APIS      24 HOURS

API CONSTANTS:

A      I      WN      WX      E1      E2      CP      K      M      POW
-----
3.00  5.50  15      45      0.75  0.85  2.00  0.60  3.0  2.00

CARRYOVER VALUES:

API      %SC      STORM      DUR HRS
-----
0.30  0.0  0  0

```