

V.3.3-API-MKC KANSAS CITY (MBRFC) API-RUNOFF OPERATION

Identifier: API-MKC

Application: All programs

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

API values are 24-hourly and runoff values are 6-hourly. Input data are zonal rainfall/melt and water-equivalent amounts.

Special provisions of this Operation include:

1. The constants and recession values for all API/AI relationships for the Kansas City and Minneapolis RFC's are contained in this Operation. The user can specify which relationship for either RFC is to be applied to a particular runoff zone during setup. If none of the canned relationships is desired, users may input their own constants and recession values.
2. The minimum period for which the Operation can be executed is 1 day. In the Operational Forecast System the day ends at 12Z.
3. The time interval for rainfall/melt and runoff for this Operation is fixed at 6 hours.
4. Input values of water-equivalent are daily values at 12Z.
5. Initial carryover values may be specified by the user for a runoff zone during setup. These values include the storm period counter, storm total rainfall/melt, storm AI value, storm total runoff, current API value, current AI value and current water equivalent. If default carryover values are used, the storm period counter is initially set to 4 and the rest of the values are initially set to zero.
6. The 24 hour rainfall/melt is stored with the carryover for display purposes. This value is always set to zero for a runoff zone during setup.
7. The option is available to allow the user to request output time series containing daily values of the current API and/or unadjusted AI.

Developed By: Missouri Basin River Forecast Center

Allowable Time Interval: 6 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
Rainfall/melt	L	MM	I	yes	n/a	6	no
Water Equiv.	L	MM	I	yes	n/a	24	no
Runoff	L	MM	O	yes	Replaces	6	no
Current API	L	MM	O	no	Replaces	24	no
Current AI	DLES	R	O	no	Replaces	24	no

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

Card	Format	Columns	Contents
1	6A4	1-24	Runoff zone name
	I6	25-30	Runoff zone number (not used by the Operation; or external use only); range of 101 thru 4092
	1X,A4	32-35	User code (right-justified); must be 'MKC', 'MSP' or 'USER'
	I5	36-40	API/AI relationship number; not used if user code is 'USER'; limit is 35 for each user
	I5	41-45	Future week number; equal to the week number one week before zone is normally out of snow at end of spring snowmelt (not used by the Operation; for external use only); range of 1 thru 25
	F5.1	46-50	AI adjustment factor (tenths); limits are -5.0 through +5.0; default value is 0.0; this can be changed at run-time through the AIADJ MOD
	I5	51-55	Input carryover flag; if blank no initial carryover values are read; any positive value triggers reading of Card 4 with actual carryover values
	I5	56-60	Output time series flag for current API and/or unadjusted AI values; if blank no time series will be generated; any positive value triggers reading of Card 3 with time series information
2	I5	1-5	Data time interval of rainfall/melt and runoff time series; current version

<u>Card</u>	<u>Format</u>	<u>Columns</u>	<u>Contents</u>
			requires a time interval of 6 hours; default value is 6 hours
	2X,2A4	8-15	Internal identifier of rainfall/melt time series
	1X,A4	17-20	Data type code of rainfall/melt time series
	2X,2A4	23-30	Internal identifier of runoff time series
	1X,A4	32-35	Data type code of runoff time series
	2X,2A4	38-45	Internal identifier of water equivalent time series
	1X,A4	47-50	Data type code of water-equivalent time series

Card 3 is optional and required only if time series output is requested by the user for current API and/or AI values. The output time series flag (Columns 56-60 of Card 1) must have any positive value if Card 3 is to be read. The user may select either one or both time series to be output, but the time series information must always be in Columns 8-20 for API values and in Columns 23-35 for AI values.

3	2X,2A4	8-15	Internal identifier of current API time series; blank if no time series desired
	1X,A4	17-20	Data type code of current API time series; blank if no time series desired; normally type is 'APIS'
	2X,2A4	23-30	Internal identifier of current unadjusted AI time series; blank if no time series desired
	1X,A4	32-35	Data type code of current unadjusted AI time series; blank if no time series desired; normally type is 'AIAI'

Card 4 is optional and required only if actual carryover values are to be input. The input carryover flag (Columns 51-55 of Card 1) must have any positive value if Card 4 is to be read. If any values are entered, all must be entered.

4	I5	1-5	Storm period counter; range 0 thru 4
	F5.2	6-10	Storm total rainfall/melt (inches); range 0.0 thru 50.00
	F5.1	11-15	Storm AI value, unadjusted; range 1.1

<u>Card</u>	<u>Format</u>	<u>Columns</u>	<u>Contents</u>
			thru 9.9
	F5.2	16-20	Storm total runoff (inches); range 0.0 thru 50.00
	F5.2	21-25	API value at the end of the previous day (inches); range 0.0 thru 6.0
	F5.1	26-30	Unadjusted AI value at the end of the previous day; range 1.1 thru 9.9
	F5.2	31-35	Water-equivalent for the previous day (inches); range 0.0 thru 20.00

Card 5 is optional and required only if a user supplied API/AI relationship to be input. The RFC ID code (Columns 32-35 of Card 1) must be 'USER' if Card 5 is to be read. If any values are entered all values must be entered.

5	F7.3	1-7	C1 constant of API/AI relationship; range 0.0 thru 1.5
	F7.3	8-14	C2 constant of API/AI relationship; range -0.5 thru 1.0
	F7.3	15-21	C3 constant of API/AI relationship; range 2.0 thru 6.0
	F7.3	22-28	C4 constant of API/AI relationship; range -1.5 thru -0.5
	F7.3	29-35	C5 constant of API/AI relationship; range -2.5 thru -0.5
	F7.3	36-42	C6 constant of API/AI relationship; range -0.1 thru 0.5
	F7.2	43-49	First API recession factor of API/AI relationship; this factor is applied to rainfall/melt amount in equations; range 0.5 thru 1.0
	F7.2	50-56	Second API recession factor of API/AI relationship; this factor is applied to previous API value in equations; range 0.5 thru 1.0

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. **\*\*ERROR\*\*** ILLEGAL API/AI RELATIONSHIP NUMBER XX FOR RFC ID CODE 'XXXX'

API/AI CONSTANTS DO NOT EXIST FOR THIS NUMBER.

Action: Select valid API/AI relationship number and change Card 1.

2. **\*\*ERROR\*\*** ILLEGAL RUNOFF ZONE NUMBER: XXXX  
LIMITS ARE... 101 THRU 4092

Action: Correct zone number on Card 1.

2. **\*\*ERROR\*\*** ILLEGAL RFC ID CODE; 'XXX'  
CHOICE MUST BE EITHER 'MKC', 'MSP' or 'USER'.  
NO API/AI CONSTANTS OR RECESSION FACTORS CAN BE LOCATED.

Action: Correct the RFC ID code on Card 1. Make sure code is right justified in field. If 'USER' is entered be sure to supply Card 5.

4. **\*\*ERROR\*\*** ILLEGAL API/AI RELATIONSHIP NUMBER: XX  
LIMITS ARE... 1 THRU 35  
NO API/AI CONSTANTS OR RECESSION FACTORS CAN BE LOCATED.

Action: Correct API/AI relationship number on Card 1.

5. **\*\*ERROR\*\*** ILLEGAL FUTURE WEEK NUMBER: XX  
LIMITS ARE... 1 THRU 25

Action: Correct future week number on Card 1.

6. **\*\*ERROR\*\*** ILLEGAL INITIAL AI ADJUSTMENT FACTOR: XX.X  
LIMITS ARE... -5.0 THRU +5.0

Action: Select correct AI adjustment factor and change Card 1.

7. **\*\*ERROR\*\*** ILLEGAL TIME STEP (DELTA-T): XX  
VALUE MUST BE 6 HOURS. IF LEFT BLANK or ZERO,  
DEFAULT IS 6 HOURS.

Action: Either punch a value of 6 hours or leave field blank on Card 2.

8. **\*\*ERROR\*\*** ILLEGAL INITIAL CARRYOVER VALUE.  
ONE OF THE FOLLOWING VALUES IS OUTSIDE LIMITS.

<u>Item</u>	<u>Limits</u>	<u>Value Entered</u>
NEWSTM	0 thru 4	XX
RAINCO	0.0 thru 50.0	XX.XX
AICO	1.1 thru 9.9	XXX.X

ROCO	0.0 thru 50.0	XX.XX
API	0.0 thru 6.0	XX.XX
AI	1.1 thru 9.9	XXX.X
WE	0.0 thru 20.0	XX.XX

Action: Determine which of the carryover values is incorrect and change Card 4. If the input carryover flag (columns 51-55 of Card 1) is blank (zero) no Card 4 should be entered.

9. **\*\*ERROR\*\*** ILLEGAL USER SUPPLIED API/AI CONSTANTS OR RECESSION VALUES.  
ONE OF THE FOLLOWING VALUES IS OUTSIDE LIMITS.

<u>Item</u>	<u>Limits</u>	<u>Value Entered</u>
C1	0.0 thru 1.5	X.XXX
C2	-0.5 thru 1.0	X.XXX
C3	2.0 thru 6.0	X.XXX
C4	-1.5 thru -0.5	X.XXX
C5	-2.5 thru -0.5	X.XXX
C6	-0.1 thru 0.5	X.XXX
REG1	0.5 thru 1.0	X.XX
REG2	0.5 thru 1.0	X.XX

Action: Determine which of the constants or recession values is incorrect and change Card 5. If 'USER' is not specified as the ID code (columns 32-35 on Card 1) no Card 5 should be entered.

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 or carryover data are made during the transfer process.
2. No alteration of the carryover data is required during the transfer process.

Punched Card Rules: The following rules are used when punching input cards for this Operation:

1. The format of punched cards is identical to those described in the Input Card Summary of this documentation.
2. No checks for the validity of the parametric or carryover data are made during the punching process.
3. The time interval of the rainfall/melt and runoff time series used by this Operation will always be punched as a value of 6. This is true even if the value was defaulted during the original setup.
4. Carryover values may be defaulted if desired and Card 4 for each runoff zone will not be punched. The input carryover flag

(Columns 51-55 of Card 1) will correspondingly be punched with a zero value.

Figure 1. Sample Card Input For Operation API-MKC

```

          - Column -
    5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
  +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
API-MKC      AFTNC
PECATONICA AFTON          902  MSP   23   10 -0.5    1    1
    6  AFTNC    RAIM  AFTNC  INFW  AFTNC    SWE
    0  AFTNC    APIS  AFTNC  AIAI
    0    0  2.0    0  0.5  2.0    0
  
```

Figure 2. Sample Output From Operation API-MKC Print Parameter Routine

```

*****
API-MKC OPERATION      NAME=AFTNC      PREVIOUS NAME=
*****

      ZONE NAME:  PECATONICA AFTON      ZONE NUMBER:  902      RFC ID CODE:  MSP
      API/AI REL NO:  23      FUTURE WEEK NO:  10
      AI ADJ FACTOR:  -0.5      C/O INPUT FLAG:  1

      TIME SERIES USED BY THIS OPERATION...
      CONTENTS          TS I.D.      TYPE      TIME INTERVAL
      -----          -
      RAINFALL/MELT    AFTNC      RAIM      6 HOURS
      RUNOFF           AFTNC      INFW      6 HOURS
      WATER EQUIVALENT AFTNC      SWE       24 HOURS
      CURRENT API      AFTNC      APIS      24 HOURS
      CURRENT AI       AFTNC      AIAI      24 HOURS

      API/AI CONSTANTS AND RECESSON FACTORS...
      C1      C2      C3      C4      C5      C6      REG1      REG2
      0.408   0.108   3.974  -0.747  -2.058  0.016  0.90     0.90

      CARRYOVER VALUES...
      NEWSTM  RAINCO  AICO    ROCO    API     AI     WE     TOT24
      0       0.00   2.0     0.00   0.50   2.0   0.00   0.00
  
```