

# Continuous Incremental API (API-CONT) Model

## 1. Description of Algorithm

<https://vlab.ncep.noaa.gov/documents/207461/1893022/23apicont.pdf>

## 2. Model Parameters

API-CONT uses the existing NWSRFS operation definition for defining model parameters. The NWSRFS operation definition is enclosed within a single parameter element named "OPERATION\_CONENTS". An example is shown below. For further information see:

<https://vlab.ncep.noaa.gov/documents/207461/1893022/533apicont.pdf>

```
N.BR.POT-KITZMILLER 6 KITM2POT RAIM KITM2POT INFW
WKN SASC SURO GWRO APIC PROT 0
KITM2POT 6
KITM2SFC KITM2POT
KITM2POT 6
1.00 4.0011.000.6000.750 0.60 1.40 0.80
0.011 0.900.0900.005 0.05 0.10 8.50 10.0 0.92
9. 31.
.98000.850 3.50 4.00 0.50
1.10 0.60 1.87 0.56
```

Other xml elements exist in the parameter file is used for the following purposes:

- The FFH general adapter expects a parameter called "TS\_ID"
- The APICCO modifier GUI expects two parameters called "APIX and SMIX"

**Note:** If the APIX or/and SMIX value in OPERATIONS\_CONTENTS is modified, then the individual xml tag is necessary to ensure value consistency.

## 3. Model States

API-CONT model states are defined in a property file format. An example is shown below. The model state property names are:

Property Name	Description
UNIT	Units for state variables (always ENGLISH)
ANTECEDENT_ PRECIPITATION_INDEX	Should be .GE. 0 and .LE. APIX Units of IN
SURFACE_MOISTURE_ INDEX	Should be .GE. 0 and .LE. SMIX Units of IN

Property Name	Description
BASEFLOW_STORAGE_CONTENTS	Units of IN
BASEFLOW_INDEX	Should be .GE. 0 Units of IN
FIRST_QUADRANT_INDEX	Not used if value of Card2 columns 3-5 is 'WKN' If 'AEI' then units is IN If 'ATI' then units is DEGF
FROST_INDEX	Should be .LE. 32 Units of DEGF
FROST_EFFICIENCY_INDEX	Should be .GE. 0 and .LE. 1 Only needed if Card 2 columns 7-10 is 'FRZE'

An example is shown below:

UNIT=ENGLISH  
ANTECEDENT\_PRECIPITATION\_INDEX=0.725806  
SURFACE\_MOISTURE\_INDEX=0.567210  
BASEFLOW\_STORAGE\_CONTENTS=1.406210  
BASEFLOW\_INDEX=0.243487  
FIRST\_QUADRANT\_INDEX=0.000000  
FROST\_INDEX=32.000000  
FROST\_EFFICIENCY\_INDEX=0.000000

#### 4. Model Time Series

API-CONT has 3 required input time series, 2 optional input time series, and 15 optional output time series.

Allowable time intervals: 1, 2, 3, 4, 6, 8, 12 and 24 hours

INPUT TIMESERIES:

Time Series Type	Internal Model Units	Time Step	Missing Values Allowed	Required [Yes or No]
Precipitation (RAIM)	MM	Any	No	Yes
Potential evaporation (MAPE)	MM	24	No	Yes <sup>2</sup>
Air temperature (MAT)	DEGC	Any <sup>3</sup>	No	Yes <sup>2</sup>
Areal snow cover (SASC)	PCTD	Any <sup>3</sup>	No	No
Water-equivalent (SWE)	MM	Any <sup>3</sup>	No	No

OUTPUT TIMESERIES:

Time Series Type	Internal Model Units	Time Step	Missing Values Allowed	Required [Yes or No]
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Time Series Type	Internal Model Units	Time Step	Missing Values Allowed	Required [Yes or No]
Total runoff (INFW)	MM	Any <sup>1</sup>	No	No
Storm runoff (SURO)	MM	Any <sup>1</sup>	No	No
Groundwater runoff or discharge (GWRO)	MM or CMS	Any <sup>1</sup>	No	No
Antecedent index (AIAI)	MM	Any <sup>3</sup>	No	No
APIS	MM	Any <sup>3</sup>	No	No
Frost index (FGIX)	DEGC	Any <sup>3</sup>	No	No
API contents (APIC) <sup>4</sup>	MM	Any <sup>3</sup>	No	No
Antecedent evaporation Index (AEIS)	MM	Any <sup>3</sup>	No	No
Antecedent Temperature Index (ATI)	DEGC	Any <sup>3</sup>	No	No
Percent surface runoff (PSRO)	PCTD	Any <sup>1</sup>	No	No
Frost efficiency index (FEIX)	PCTD	Any <sup>3</sup>	No	No

**Note:**

<sup>1</sup>Must be the same as the data time interval for precipitation.

<sup>2</sup>Required only if AEI, ATI or frozen ground options used.

<sup>3</sup>Mus be an even multiple of the data time interval for precipitation.

<sup>4</sup>Write out five separate output time series such as API, AI, SMI, BFSC, and BFI.

## 5. Modifications (Mods)

The API-CONT model has nine mods it accounts for.

Parameter Id	Internal Model Units	Time Step	Description
AEICQN Modifier			
AEICQN <sup>4</sup>	MM	Any <sup>2</sup>	Changes the antecedent evaporation index
APICBASF Modifier			
APICBASF	REAL	Any <sup>1</sup>	Multiplies the baseflow runoff by the specified value
APICCO Modifier			
SMI <sup>3</sup>	MM	Any <sup>2</sup>	State change: surface moisture index
BFSC <sup>3</sup>	MM	Any <sup>2</sup>	State change: baseflow storage contents
BFI <sup>3</sup>	MM	Any <sup>2</sup>	State change: baseflow index

API <sup>3</sup>	MM	Any <sup>2</sup>	State change: antecedent precipitation index
FEI <sup>3</sup>	REAL	Any <sup>2</sup>	State change: frost efficiency index
FI <sup>3</sup>	DEGC	Any <sup>2</sup>	State change: frost index

<sup>1</sup> a non-equidistant time series; date and time must coincide with a model time step.

<sup>2</sup> an equidistant time series; date and time must coincide with a model time step.

<sup>3</sup> This mod is 1 of 6 components that make up the NWSRFS APICCO mod. There can be no more than 10 dates defined for a given run. Each date can have 1 or more components.

<sup>4</sup> Maximum of 5 time steps with a modified value.

### AIADJ parameter

AIADJ is a parameter mod.

## 6. Notes about configuring Model in FEWS workflow

Examples:

Module Configuration File

[ModuleConfigFiles\APICONT\\_FDKM2MCY\\_FDKM2MCY\\_Forecast.xml](#)

Module Parameter File

[ModuleParFiles\APICONT\\_FDKM2MCY\\_FDKM2MCY\\_UpdateStates.xml](#)

## 7. FEWS Adapter Used

The Continuous Incremental API model uses the OHDFewsadapter to communicate. Information about this adapter can be found at [OHDFewsadapter](#).

### Run Time Options

API-CONT allows property key options to be defined. When specified, they should appear in the run\_info.xml file. The MapeTimeStep allows the setting of a different input MAPE time interval. The default value is 24 if the property is not defined.

```
<int key="printDebugEnabled" value="0"/>
<string key="mapeTimeStep" value="6"/>
```