Bookmarks

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Purpose


Run time modifications (MODs) are used by Function FCEXEC to make
changes to time series or carryover values.

The MODs are used at forecast execution time to adjust these values in
an attempt to improve the results of the forecast model computations.
MODs are also available for making temporary or permanent changes to
selected parameters.  MODs have been provided to change only
parameters that have considerable variability such as the unit
hydrograph shape, AI correction factor and baseflow recession for use
with API models.  Most parameters can be changed only through the
Segment redefinition command in the Forecast Component Initialization

Program (FCINIT).  Even though most MODs are used to make temporary
changes the effects of these changes are made permanent whenever MODs
are included and carryover is saved for dates after the modifications.

Run time control of general Function FCEXEC options (e.g. snow/no
snow, length of forecast period, save carryover) is through Techniques
which can be changed using HCL commands.  MODs are usually for a more
specific purpose and/or require the input of more information than can
be easily accomplished through Techniques.  The input structure of
MODs is command oriented.

A very important feature of the MODs input is that each of the MODs
has a date (or range of dates) associated with it.  This mechanism
insures that the MODs are applied only for the time intended.  Warning
messages inform the user when MODs are included for dates outside the
current run period.  This means that MOD cards can be kept until they
can no longer be used but are applied only when the specified dates is
included in the run.  Once the dates associated with a MOD are prior
to the oldest carryover save date the MOD can no longer be used and
should be deleted.

When different users are assigned to the various Forecast Groups that
make up the user area each user can use whatever MODs they determine
are appropriate for their assigned river basins.  When the results for
those river basins are finalized the MODs for the Forecast Group can
be included with the save carryover run for the entire user area.  In
this way the changes each user makes can easily be assimilated in the
final complete user area run.

MOD Input Structure

Run-time Modifications for the FCEXEC Function have been designed to
minimize the required user input while allowing flexibility in those
parameter, carryover or time series values which can be changed.

MOD input can be provided to Function FCEXEC either directly within
the HCL stream or read from a file.  The INCLUDE MOD is used to
include records from a file and is described in VI.5.3C-FCEXEC-MOD-
INCLUDE [[Hyperlink](#)].

Basic MOD Input Structure

The structure of MOD input consists of a single card which contains
the MOD command as the first field.  This is followed by one or more
subsequent cards each of which contains an identifier or range of
identifiers specifying for which Segments or Forecast Groups the MOD
applies and other information needed to process the MOD.

If a range of identifiers is specified then the MOD is applied
starting at the first Segment identifier and stopped after the second
Segment identifier and is applied to all Segments that occur in the
computational order between the identifiers.

In a few cases the first (or command) card for each MOD contains only
the command preceded by a period.  However there are several
additional fields on most command cards.  These additional fields
specify the date or dates for which the command applies and whether
the identifiers on subsequent cards are Segment or Forecast Group
identifiers.

The remaining cards for each MOD command start with an identifier or
range of identifiers as the first field followed with information
needed to execute the MOD command.  These subsequent cards can be
repeated under one MOD command card.

General MOD Input Formats

There are two general input formats for the current MODs:

  o  Format A is used to change time series values

  o  Format B is used to make changes associated with Operations

MOD Format A

This format is used to change values in time series.

   **Command Card**

   The command card for Format A contains the MOD command preceded by a
   period as the first field on the card.  Depending on the command
   there may be zero, one or two additional fields.  If required the
   additional fields are dates specifying when the changes apply.

      .command  [ date1 ]  [ date2 ]  [ date3 ]

         where  command  is the name of name of the MOD
                date1    is either:

                                            the date for
                         which changes apply if only one date is
                         entered
                           or

                                            the starting
                         date for changes if two dates are entered

date2     is the ending date for changes
                         date3 is the date after which the MOD is no
                    longer valid

**Subsequent Cards**

The formats for subsequent cards for Format A are:

### Format A1

segid tsid datatype timeint date

   where  segid       is the Segment identifier
          tsid        is the time series identifier
          datatype    is the data type
          timeint     is the time interval
                         date  is the date or range of dates
                    for which the MOD applies

### Format A2

segid  tsid  datatype  timeint  values  ( $\begin{matrix} \text{keyword} \\ \text{optype opname} \end{matrix}$ )

   where  segid       is the Segment identifier
          tsid        is the time series identifier
          datatype    is the data type
                         values     are the value or values to
                    be used for changes

                       keyword, optype and opname are described
   below

**Keywords, Operation Types and Operation Names for Format A2**

    Format A2 allows either a keyword or an optype to be entered
to determine when the change to the time series will occur.  The
rules governing when one of these entries is required and the
defaults if no entry is made are described below.

    There are four types of time series used by the Forecast
Component which can be changed with MOD command format A2:

   o  INPUT time series are read from file and used by the
      Forecast Component

   o  OUTPUT time series are generated by the Forecast Component
      and written to the file

   o  UPDATE time series are read from file, used by the Forecast
      Component and written back to file

o INTERNAL time series are only used within a Segment by the
Forecast Component and do not reside on any file

Valid keywords are FIRST or LAST (abbreviated F or L).  FIRST
means change the time series just after it is read from file
before performing any Forecast Component computations.  LAST
means change the time series after all Forecast Component
computations just before writing to the file.  If an optype
(e.g. SAC-SMA, UNIT-HG, etc.) is entered it means to change the
time series just before any occurrence of that Operation type in
the Operations Table.  An optype may be followed by an opname
indicating that the time series is to be changed only before the
particular Operation named.  The following rules apply:

o For INPUT time series only FIRST or an optype are valid.
If no entry appears FIRST is assumed.

o For OUTPUT time series only LAST or an optype are valid.
If no entry appears LAST is assumed.

o For UPDATE time series FIRST, LAST or an optype is
required.

o For INTERNAL time series an optype is the only valid entry.
It is required.

o If keywords FIRST or LAST are entered they are the last
field on the card.  An optype may be followed by an opname.
If an opname is not specified the time series is changed
before every occurrence of Operation optype in the segment.

MOD Format B

This format is used to make changes associated with specific
Operations.

**Command Card**

The command card for Format B contains the MOD command preceded by a
period as the first field on the card.  For most of the Format B
MODs the last field of the command card is optional and is used to
specify whether the identifiers on subsequent cards are Segment
identifiers or Forecast Group identifiers.  Forecast Group
identifiers cannot be specified for some Format B MODs.  When valid
the last field on the command card must be the word FGROUP
(abbreviated FG) to designate that the identifiers on subsequent
cards are Forecast Group identifiers.  If this field is not entered
the identifiers are treated as Segment identifiers.  Depending on
the command there may be zero, one or two additional fields.  If

required the additional fields are dates specifying when the changes
apply.  These additional fields (if needed) must be entered between
the MOD command and the optional word FGROUP.

     .command  [ date1 ]  [ date2 ]  [ date3 ]  [ FGROUP ]

        where  command  is the name of the MOD
               date1    is either:
                                              the date for
                         which changes apply if only one date is
                         entered
                           or
                                              the starting
                         date for changes if two dates are entered
               date2    is the ending date for changes
               date3    is date after which the MOD is no longer valid
                         FGROUP        indicates that the identifiers
                         on subsequent cards are Forecast Group
                         identifiers instead of the default of
                         Segment identifiers

**Subsequent Cards**

The formats for subsequent cards for Format B are:

   **Format B1**

     identifier keyword date [ / opname ]

        where  identifier      is a single Segment or Forecast Group
                               identifier depending on the entry of
                               field FGROUP on the command card or a
                               range of Segment or Forecast Group
                               identifiers in the form id-id (i.e. one
                               field with a dash separating the two
                               identifiers)
                    keyword    is described with the MOD
                  command
                    date  is described with the MOD
                  command
                    opname          is a specific
                  Operation name which is an optional
                  field.  This field indicates the
                  particular Operation within a Segment
                  (or Forecast Group) for which the MOD
                  applies.  If this field is not entered
                  the MOD applies to all Operations in the
                  Segment or Forecast Group of the type
                  being changed by the MOD command
                  currently being executed.  If this field
                  is entered it must be preceded by a

field which is a slash (/).

**Format B2**

identifier keyword value [ / opname ]

    where  identifier  is as described in Format B1
                        keyword    is described with the MOD
                  command
                      value is described with the MOD
                  command
        opname       is as described in Format B1

**Format B3**

identifier values [ / opname ]

    where  identifier  is as described in Format B1
          value       is described with the MOD command
          opname      is as described in Format B1

MOD Syntax Rules

The following are the syntax rules for the format of MOD cards:

- o Input is in free format which means that commands or data need not be in specified columns on the card.  The input consists of fields separated by blanks or a comma.  A field containing blanks or commas can be entered by enclosing it in single quotes.  No field containing a single quote can be entered.
- o Columns 1 through 72 are available to enter data.  Continuation cards can be specified by entering an ampersand (&) as the last field of the card to be continued.  Fields cannot be split between two cards.

- o Commands (with a decimal point as the first character of the field) must be the first field on a card.

- o When an optional field is after a slash (/) the slash must be surrounded by blanks or commas.

- o The form of all date fields is the same as other date fields except that dates containing asterisks (*) are not allowed.  See Section VI.5.2B [Hyperlink] for the date format.

- o Data values to be repeated can be specified in a single field in the form n*value where n is the repeat factor.

- o Groups of data values can be repeated by entering them with a

format of n*(val1 val2 val3 ...) where n is the repeat factor.
Spaces are not allowed around the left parenthesis or before the
right parenthesis.  Values within the parentheses can be
repeating fields as shown in syntax rule 6.  Repeating data
groups cannot be nested.

Control of Units and Timing Information for MOD Input

Technique MODUNITS is used to specify the units of data input to most
MOD commands.  Units of data input to MOD commands which change
carryover or parameters for the Sacramento and Xinanjiang soil
moisture accounting Operations are determined from Technique MODSACUN.
The input data units for MOD commands which change the API Operations
are specified by Technique MODAPIUN.

The time zone assumed when a date is entered with an hour but no time
zone as MOD input can be specified though Technique MODTZC.  If a date
with no hour is input the hour is set to the start of the hydrologic
day (12Z).

See Section VI.5.3D [Hyperlink] for a complete description of these
Techniques.

Rules for Applying MODs

The following rules are used to determine which MODs are applied:

  o  Multiple MODs for the same time interval: When there is more than
     one MOD that applies to the same time interval:

       1. Depends on what the MOD is doing:
          a. value is being replaced - only one MOD applies per time
             interval
          B. value is being multiplied - all values are applied
             (i.e. the result is the product of all of the
             multiplication factors) except in the case of the melt
             factor correction MOD (MFC) where only one value
             applies
          c. value is being added - all values are applied (i.e. the
             total amount added is the sum of all of the MOD values)

       2. Depends on whether the MOD is explicitly specified:

                  MODS that affect Operations or Rating Curves
             generally affect all Operations of that type in a Segment
             or all Rating Curves.  Also a MOD like MATCHNG [Bookmark]
             will affect all MAT time series in a Segment.  The MOD can

be made to apply only to a specific Operation, Rating
Curve or time series by using the '/opname', '/rcid', or
'tsid' field on the MOD card.  Explicitly specified MODs
take precedence over non-explicit MODs.

3. Depends on the order:

If everything else it the same for replacements
MODs then the last one is used.

o  Use of the validdate field:

In general, changes made to future values are valid at the
time the forecast is made.  The forecasted changes for one time
should not override values based on observations at a subsequent
time.  The validdate field is used to specify the time at which
changes made to forecast values are valid.  Most MODs that allow
changes in the future require the use of the validdate field.
For MODs that use the validdate field, changes to values in the
future are made only when the validdate is the same as the end of
the observed data period (Technique LSTCMPDY [Hyperlink]).  At
subsequent forecast times when validdate is before LSTCMPDY, only
the changes at or prior to validdate are applied.  Figure 1
[Bookmark] shows the use of the validdate option.

o  MODs that overlay the run period:

When there are MODs that specify changes to the time series or
model output that span a period that is partly within and partly
outside of the run period then the part of the MOD that is within
the run period is used and the part that is outside is ignored.
In general, when dealing with time periods, the period is
specified by the hour at the end of the time period.  If dates on
MODs are within a time period then they are usually moved to the
closest period ending hour.  In a few cases, such as the AEICQN
[Bookmark] and BFRCHNG [Bookmark] MODs, they are moved to the
ending hour of the period in which they fall.

Available MODs

A list of the available MODs is in Table 1 [Bookmark].

MOD Input and Examples

The location of the MOD cards in the input stream is:

@SETOPTIONS

```
          .
     Technique input cards
          .
     MOD
          .
        MOD input cards
          .
        ENDMOD
    @COMPUTE FCEXEC
          .
     @STOP
```

The Technique input includes the type of run to be made (Carryover
Group, Forecast Group or single Segment) and overrides of default
values for the other Techniques.

The Technique input section indicates either by default or by
including Technique cards, the units of input for the MODs and the
default time zone to be used when the time zone is not specified in
the date fields of a MOD card.

The following documents contain the purpose, input format and examples
for each MOD.

In the examples:

     o units for the SACCO MOD are Metric
     o units for all other MODs are English
     o the default time zone used is CST

Table 1. Available MODs

| | Name | Format | Dates | FG 1/ | Perm 2/ | Description |
|---|---|---|---|---|---|---|
| | | | | | | [Back] |
| 1. | AEICQN | B3 | 1 | yes | no | Changes the Antecedent Evaporation Index (AEI) value in API Operations [Hyperlink] |
| 2. | AESCCHNG | B3 | 1 | yes | no | Changes the value of the areal extent of snow cover for SNOW-17 Operations [Hyperlink] |
| 3. | AIADJ | B3 | 1 | yes | yes | Changes the AI adjustment factor for API Operations [Hyperlink] |
| 4. | APICBASF | B3 | 1 | yes | no | Multiplies the baseflow runoff from Operation API-CONT by a constant [Hyperlink] |
| 5. | APICCO | B3 | 1 | yes | no | Changes the Operation API-CONT carryover values [Hyperlink] |
| 6. | APICQN | B3 | 1 | yes | no | Changes the API value in event API Operations [Hyperlink] |
| 7. | BASEF | B3 | 1 | no | no | Changes the recessing baseflow amount in baseflow Operations (value entered as flow) [Hyperlink] |
| 8. | BFRATE | B3 | 1 | yes | no | Changes the recessing baseflow amount in baseflow Operations (value entered as flow per area) [Hyperlink] |
| | | | | | | [Back] |
| 9. | BFRCHNG | B3 | 1 | yes | yes | Changes the recession factor for baseflow Operations with a single recession factor [Hyperlink] |

| | | | | | |
|---|---|---|---|---|---|
| 10. BUBLSHFT | B3 | 2 | no | no | Shifts the Rating Curve by specifying a new stage, discharge point and upper and lower stage values [Hyperlink] |
| 11. CBASEF | B3 | 1 | no | yes | Changes the constant baseflow amount for baseflow Operations (value entered as flow) [Hyperlink] |
| 12. CBFRATE | B3 | 1 | yes | yes | Changes the constant baseflow amount for baseflow Operations (value entered as flow per area) [Hyperlink] |
| 13. CHGBLEND | B3 | 1 | yes | yes | Changes the length of blending period in Operation ADJUST-Q [Hyperlink] |
| 14. IGNORETS | B2 | 2 | yes | no | Sets which types of data are to be ignored by Operations ADJUST-Q and RES-SNGL [Hyperlink] |
| 15. INCLUDE | N/A | N/A | N/A | N/A | Includes MOD statements from a files [Hyperlink] [Back] |
| 16. MATCHNG | B2 | 2 | yes | no | Changes values in MAT time series [Hyperlink] |
| 17. MFC | B3 | 2 | yes | no | Changes the melt factor correction value for Operation SNOW-17 [Hyperlink] |
| 18. QCSHIFT | B3 | 2 | no | no | Shifts a Rating Curve by a constant discharge amount for a specified period [Hyperlink] |
| 19. QPSHIFT | B3 | 2 | no | no | Shifts a Rating Curve by a percent discharge amount for a specified period [Hyperlink] |
| 20. RAINSNOW | B1 | 0 | yes | no | Sets whether precipitation |

|  |  |  |  |  |  | during a period is rain or snow [Hyperlink] |
| --- | --- | --- | --- | --- | --- | --- |
| 21. | ROCHNG | B3 | 1 | yes | no | Changes the runoff values just before a unit hydrograph Operation [Hyperlink] |
| 22. | ROMULT | B3 | 2 | yes | no | Multiplies runoff values by a constant just before a unit hydrograph Operation [Hyperlink] |
| 23. | RRICHNG | B3 | 1 | yes | no | Changes the moisture input time series to a rainfall/runoff model [Hyperlink] |
| 24. | RRIMULT | B3 | 2 | yes | no | Multiplies the moisture input time series to a rainfall/runoff model by a specified value [Hyperlink] |
| 25. | SACBASEF | B3 | 1 | yes | no | Multiplies the baseflow runoff from the SAC-SMA model by a constant [Hyperlink] |
| 26. | SACCO | B2 | 1 | yes | no | Changes the SAC-SMA soil moisture carryover values [Hyperlink] |
| 27. | SETMSNG | A1 | 0 | no | no | Sets values in a time series to missing [Hyperlink] |
| 28. | SETQMEAN | B3 | 1 | no | no | Overrides rules specified in Operation RES-SNGL with mean flow values entered [Hyperlink] |
| 29. | SSARREG | B2 | 1 | no | no | Sets regulation values to Operation SSARRESV [Hyperlink] |
| 30. | SWITCHTS | B2 | 3 | yes | no | Indicates that the secondary time series defined for a MERGE-TS Operation to be used as input [Hyperlink] |

| | | | | | |
|---|---|---|---|---|---|
| 31. TSADD | A2 | 2 | no | no | Adds a constant to values in a time series [Hyperlink] |
| 32. TSCHNG | A2 | 1 | no | no | Changes the values in a time series [Hyperlink] |
| 33. TSMULT | A2 | 2 | no | no | Multiplies the values in a time series by a constant [Hyperlink] |
| 34. TSREPL | A2 | 2 | no | no | Replaces values in a time series with a constant [Hyperlink] |
| 35. UADJ | B3 | 2 | yes | no | Multiplies the average wind function adjustment (UADJ) parameter for Operation SNOW-17 [Hyperlink] |
| 36. UCBASEF | B3 | 1 | no | yes | Changes the constant baseflow amount for unit hydrograph Operations (value entered as flow) [Hyperlink] |
| 37. UCBFRATE | B3 | 1 | yes | yes | Changes the constant baseflow amount for unit hydrograph Operations (value entered as flow per area) [Hyperlink] |
| 38. UHGADJ | B2 | 1 | yes | no | Changes a unit hydrograph with horizontal and/or vertical adjustment factors [Hyperlink] |
| 39. UHGCDATE | B3 | 3 | no | no | Changes the ordinates of a unit hydrograph for a specified part of the run period [Hyperlink] |
| 40. UHGCHNG | B3 | 1 | no | no | Changes the ordinates of a unit hydrograph for the entire run period [Hyperlink] |
| 41. WEADD | B3 | 1 | yes | no | Adds the value of snow water equivalent for a |

specified date [Hyperlink]

| | | | | | |
|---|---|---|---|---|---|
| 42. WECHNG | B3 | 1 | yes | no | Changes the value of snow water equivalent for a specified date [Hyperlink] |
| 43. WEUPDATE | B2 | 1 | yes | no | Changes the snow water equivalent and the associated variance or gain to be used in Kalman filtering updating [Hyperlink] |
| 44. XINCO | B2 | 1 | yes | no | Changes the Operation XIN-SMA soil moisture carryover values [Hyperlink] |
| 45. ZERODIFF | B2 | 1 | no | no | Resets the carryover in Operation ADJUST-Q at the start of the run [Hyperlink] |
| 46. DPRECIP | B3 | 1 | no | no | multiplies the moisture input to the SAC-SMA portion of DHM-OP.  The precip in each grid cell in the basin modeled with the DHM-OP is multiplied by the mod value [Hyperlink] |
| 47. DSACST | B2 | 1 | yes | no | sets a multiplier for the specified SAC-SMA content and date [Hyperlink] |

Notes:

1/  Indicates whether Forecast Group identifiers can be specified.

2/  Indicates whether the change is permanent in program FCST (none are permanent in program IFP).  If the change is permanent then the value stored in the Forecast Component parameter file is changed.
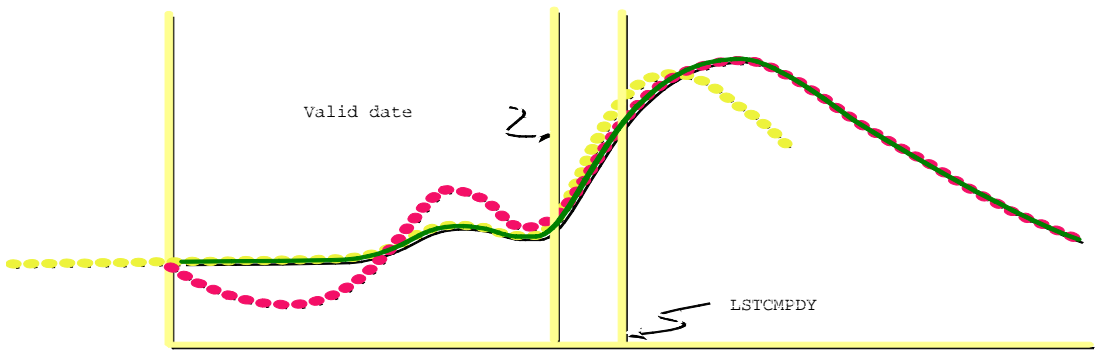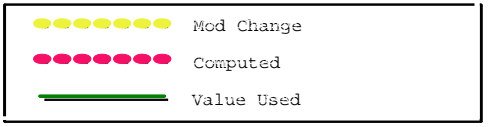
Figure 1. MODs and the validdate field
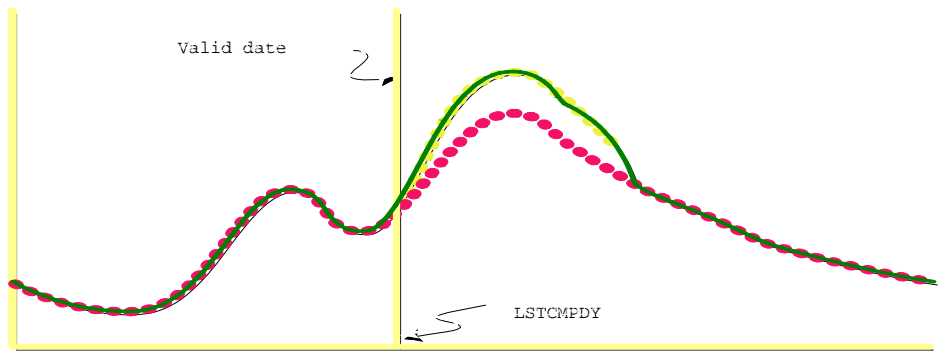
A. Valid Date Equals LSTCMPDY
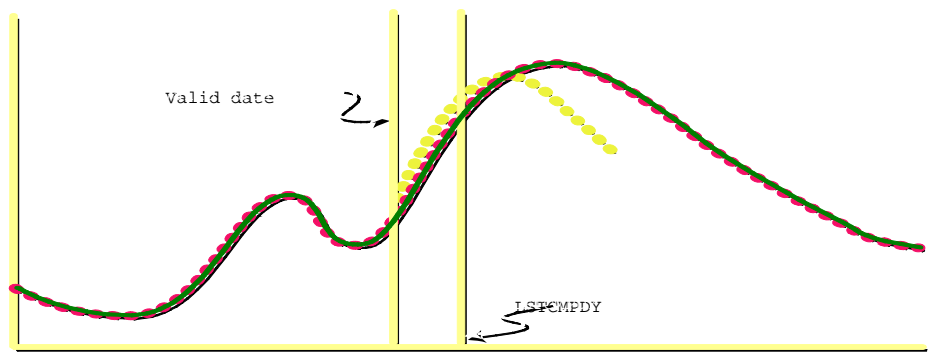


B. Valid Date Less Than LSTCMPDY



C. Valid Date Used With Values That Overlap the Run Period

Mod Change

Computed

Value Used

[Top]