Unit Hydrograph (UNIT-HG) Model

Description of Algorithm

http://www.weather.gov/ohd/hrl/nwsrfs/users_manual/part2/_pdf/24unithg.pdf

Model Parameters

Unit-HG uses an xml representation of model parameters where each parameter is captured within a separate xml tag. The tags are closely related to the NWSRFS definition of UNIT-HG defined at http://www.weather.gov/ohd/hrl/nwsrfs/users_manual/part5/_pdf/533unithg.pdf.

The table below shows the available parameter tags.

Name	Type	Required [Yes/No]	Comment
UNIT_TYPE	String	Yes	○ "Metric" or "English": ○ Default is METRIC
UHG_ORDINATES	Table	Yes	○ Ordinate(s) units should match UNIT_TYPE parameter
UHG_DURATION	Integer	Yes	○ Time period of rain which produced the runoff; ○ Value in HRs
UHG_INTERVAL	Integer	Yes	○ Interval of ORDINATES, not to be confused with DURATION. Use this value as output discharge TS interval; ○ Value in HRs.
CONSTANT_BASE_FLOW	Double	Yes	○ cms or cfs depending on UNIT_TYPE
DRAINAGE_AREA	Double	Yes	○ Value in Km^2 or Mi^2 depending on UNIT_TYPE

Model States

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

Property Name	Description
UHG_DURATION	UHG duration in HRs
UHG_INTERVAL	UHG time interval in HRs
UHG_ORDINATE_NUM	Number of OHG ordinates
RUNOFF#0 – RUNOFF#N	Where N=
RUNOFF_UNIT	Units for RUNOFF State Variables [mm or in]

Sample States File:
RUNOFF#0=0.0
RUNOFF#1=0.0
RUNOFF#2=9.0
UNIT=METRIC
UHG_DURATION=6
UHG_INTERVAL=6
UHG_ORDINATE_NUM=3

Model Time Series

INPUT TIMESERIES:

Time Series Type	Internal Model Units	Time Step	Missing Values Allowed	Required [Yes or No]
Runoff (“TCI”)	MM	any	No	Yes
Discharge 1/	CMS		No	No

OUTPUT TIMESERIES

Time Series Type	Internal Model Units	Time Step	Missing Values Allowed	Required [Yes or No]
Discharge	CMS		No	Yes

Notes:
1/: Input discharge time series is optional and is used when using additive feature.

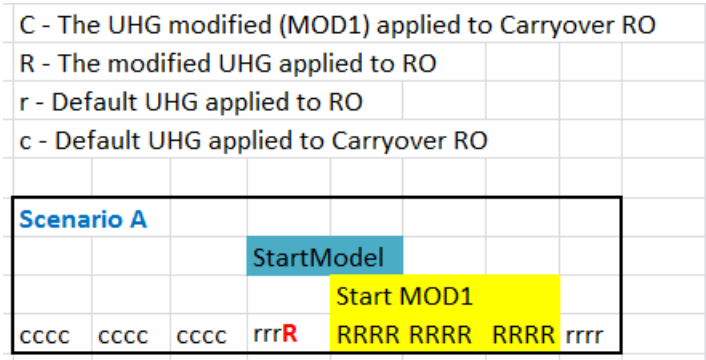
Modifications (MODS)

The Unit-HG mod changes the ordinates of the unit hydrograph. Mod values are stored in Fews database and exported at run time to the parameter XML files. When a MOD is defined, the parameter XML file contains multiple definitions of the UHG_ORDINATES parameter; each UHG_ORDINATE is contained within a parameter group where each group has a valid period describing when to apply the mod. By default, the "default" group UHG_ORDINATES are used.

Parameter	Units
<parameter id="UHG_ORDINATES">	cms/mm

- All mods need a start and end date (i.e. UHGCDATE type MOD) a single date mod (i.e. UHGCHNG type MOD) does not exist in CHPS
- Runoff (RO) as input and carryover are inputs and Discharge (Q) is output
- Each runoff is multiplied by all UHG ordinates; the results are spread forward in time
- The Q at a given time is a function of (n-1) previous runoffs, where n is the number of ordinates
- The MOD ordinates are applied to all RO values that contribute to the Q (starting at the beginning of the MOD through the end of the MOD)
- There are several MOD scenarios

A. When the start date of the MOD is after the start of the run, The MOD ordinates are not applied to the Carryover Runoff values. The MOD is applied to all RO values starting one time step before the start of the mod through the end of the MOD. The default UHG_ORDINATES are applied to any remaining runoff. (*See Example A*)



B. When the start date of MOD is before or the same date as model start run, the MOD ordinates are applied to the Carryover Runoff and RO values until the end of the MOD. The default UHG_ORDINATES are applied to any remaining runoff. (*See Example B*)

C - The UHG modified (MOD1) applied to Carryover RO
R - The modified UHG applied to RO
r - Default UHG applied to RO
c - Default UHG applied to Carryover RO

Scenario B1 (same)							
			StartModel				
			Start MOD1				
CCCC	CCCC	CCCC	RRRR	RRRR	RRRR	rrrr	rrrr

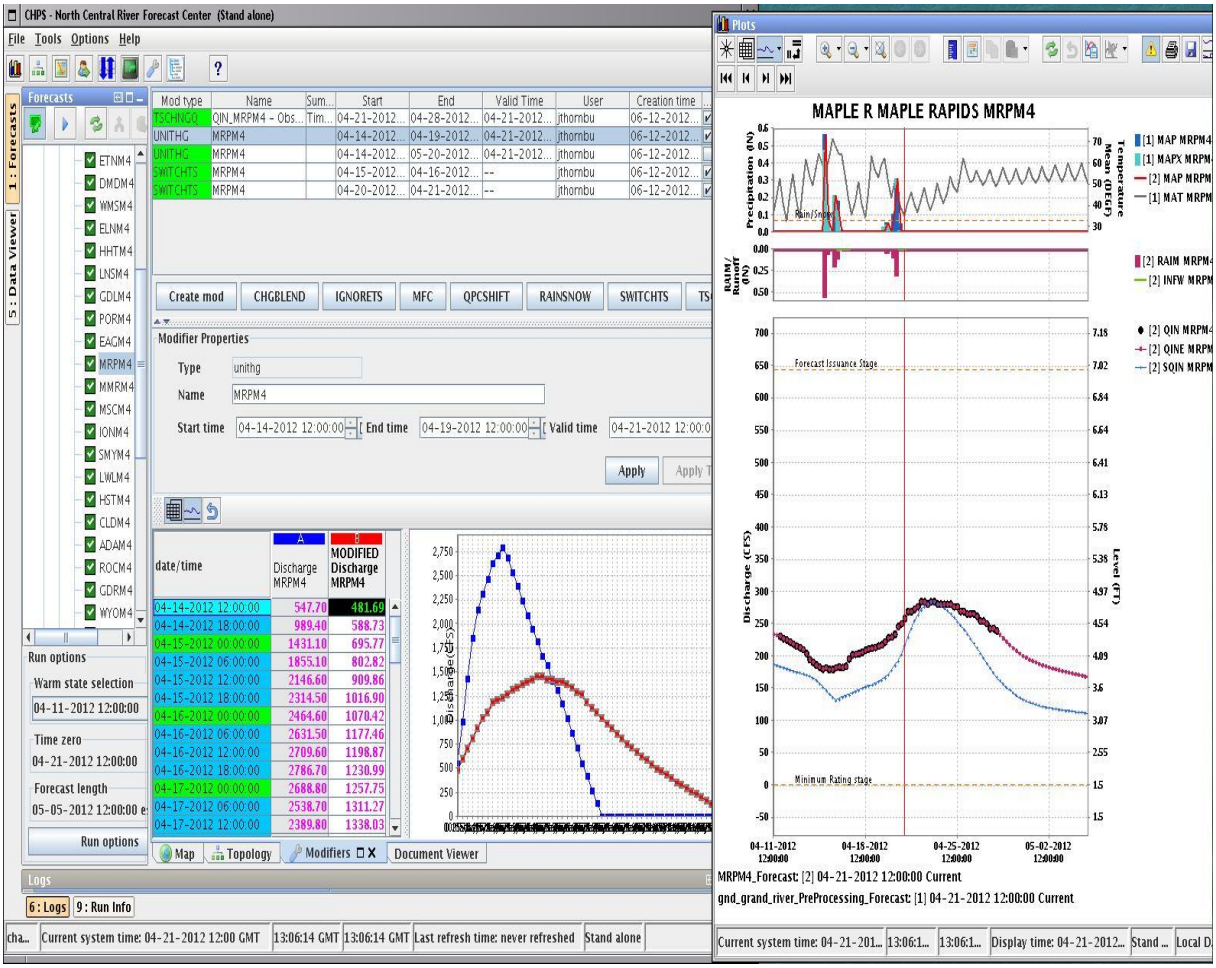
Scenario B2 (before)							
			StartModel				
	Start MOD1						
CCCC	CCCC	CCCC	RRRR	rrrr	rrrr	rrrr	rrrr

C. If there is more than one MOD, the first MOD is applied the scenario "A" or "B" and the modified UHG of second MOD be applied only to the Carryover Runoff values or RO values representing during the mod periods. The default UHG_ORDINATES are applied to any remaining runoff. (*See Example C-A*)

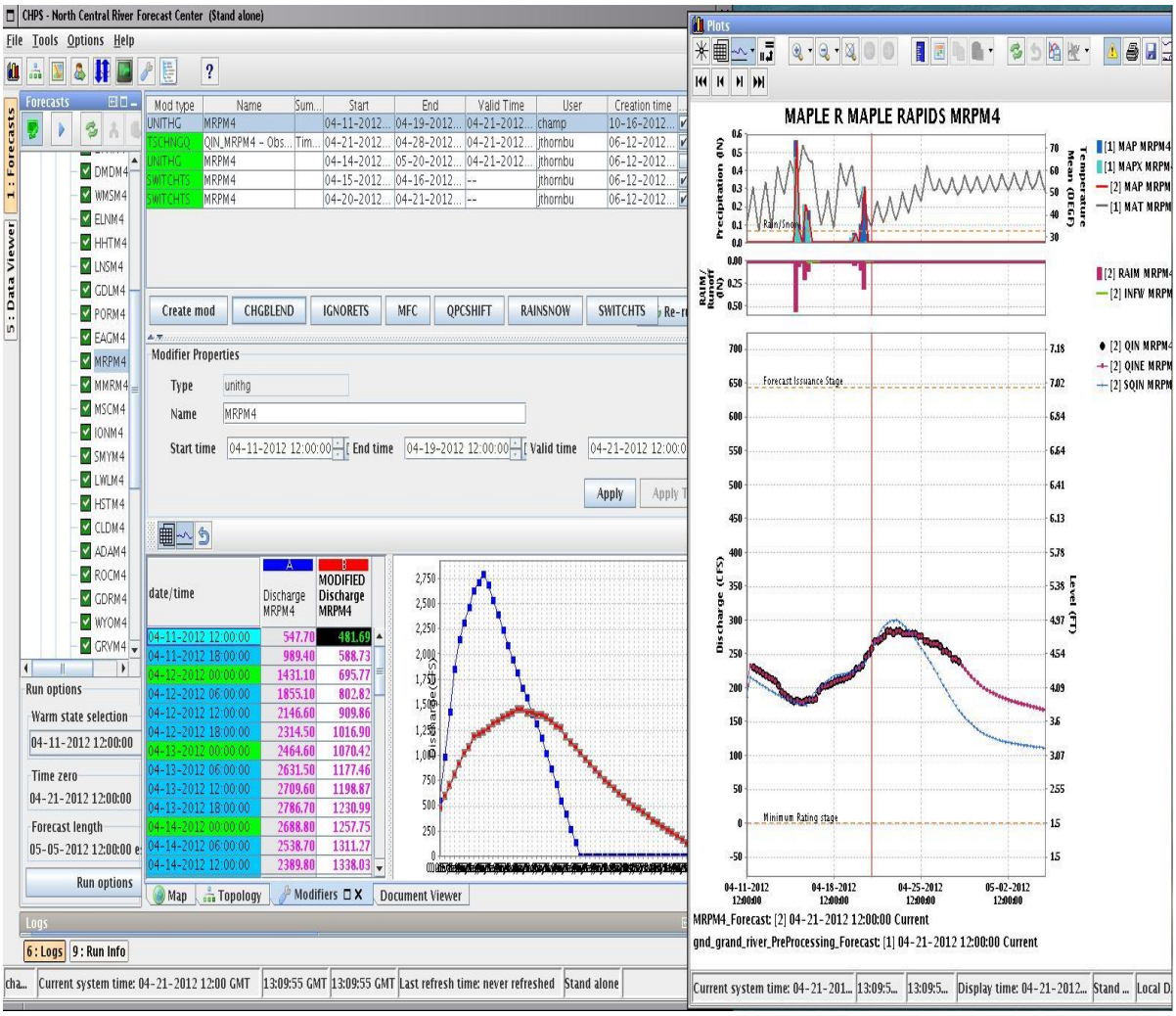
C - The UHG modified (MOD1) applied to Carryover RO
R - The modified UHG applied to RO
r - Default UHG applied to RO
c - Default UHG applied to Carryover RO

Scenario C - A											
			StartModel								
				Start MOD1				Start MOD2			
CCCC	CCCC	CCCC	rrr**R**	RRRR	RRRR	RRRR	rrr**R**	RRRR	RRRR	RRRR	rrrr
Scenario C - B1											
			StartModel								
			Start MOD1					Start MOD2			
CCCC	CCCC	CCCC	RRRR	RRRR	RRRR	rrrr	rrr**R**	RRRR	RRRR	RRRR	rrrr

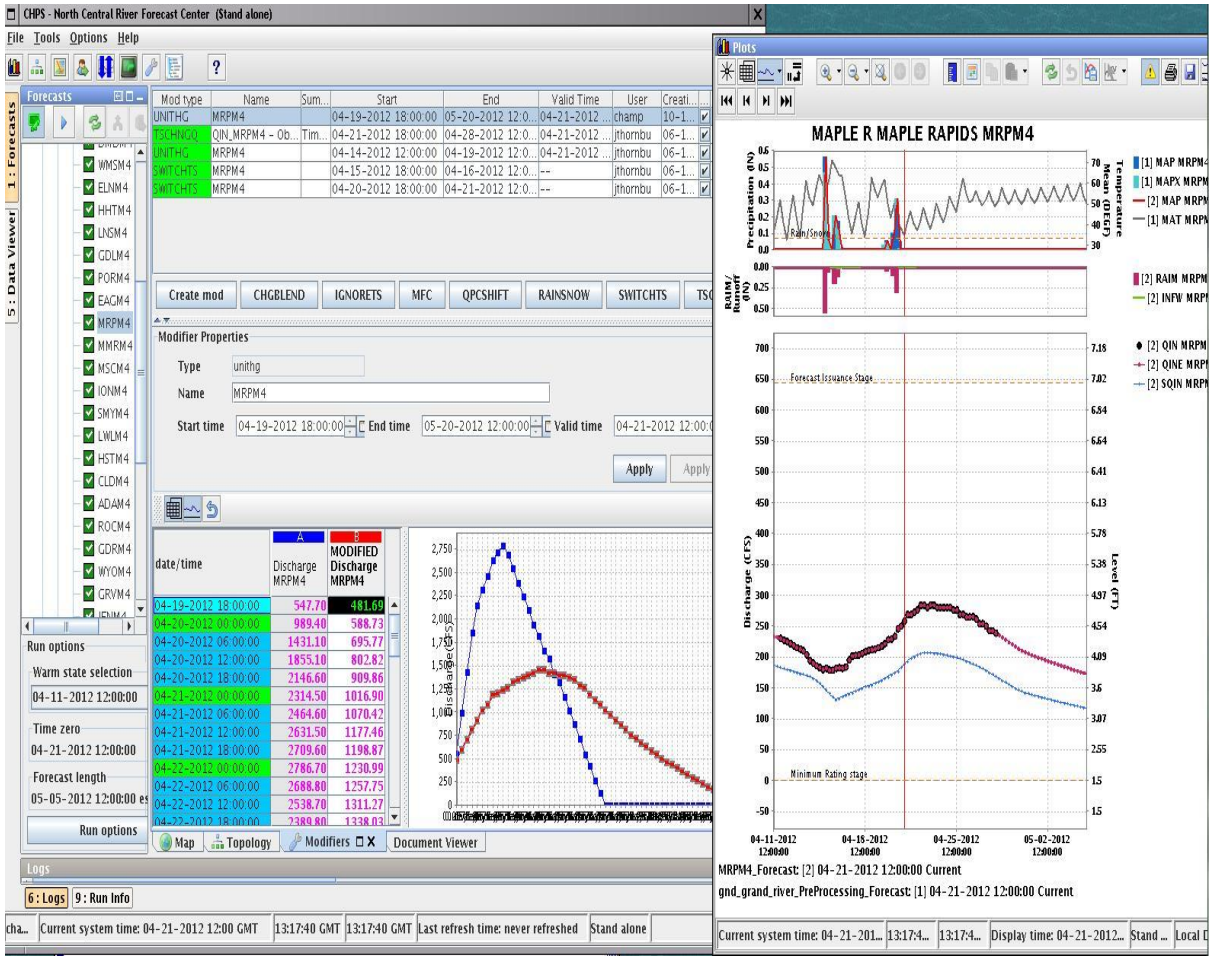
Example A: Model start run: 04/11/2012 12Z
MOD start date: 04/14/2012 12Z
MOD end date: 04/19/2012 12Z



Example B: Model start run: 04/11/2012 12Z
MOD start date: 04/11/2012 12Z
MOD end date: 04/19/2012 12Z



Example C-A: Model start run: 04/11/2012 12Z
MOD1 start date: 04/14/2012 12Z
MOD1 end date: 04/19/2012 12Z
MOD2 start date: 04/19/2012 18Z
MOD2 end date: 05/20/2012 12Z



Notes about configuring Model in FEWS workflow

Examples:
Module Configuration File
ModuleConfigFiles\UNITHG_ABEC2_ABEC2_Forecast.xml
Module Parameter File
ModuleParFiles\UNITHG_ABEC2_ABEC2_UpdateStates.xml

FEWS Adapter Used

The Unit-HG model uses the OHDFewsadapter to communicate. Information about this adapter can be found at OHDFewsadapter.