HEC-ResSim 3.0

Enhancements and New Capabilities

Fauwaz Hanbali
August 4, 2005
HEC-ResSim Program

- HEC Next Generation Software
- Real-time and planning application for water control management systems
- V2.0 Public Release (October 2003)
- New Capabilities ~ upcoming V3.0
Standard Capabilities

- Networked Reservoir and Flow Routing
- Guide Curve and Zone-Based Reservoir Operation
- At-site Release Function Rules
- Downstream Control Function Rules
- Parallel and Tandem System Operation
- Incidental and Scheduled Hydropower
- Emergency Gate Operation
- Release Overrides
Network Elements

- Reservoirs – mass balance, release decision
- Reaches – flow routing, losses
- Diversions – withdrawals, routing, losses
- Junctions – control points and connections (link reservoirs, reaches, diversions, plus local inflows)
Simulation & Analysis

- Multiple Alternatives

Reservoir Plot

- Flood Control Zone

Simulation Control
Simulation: 01 Jan 1982, 1200
Lookback: 01 Jan 1982, 0200
End: 04 Feb 1982, 1700

Flow (cms)

Elev. (m)

Alt. A – Inflow
Alt. D – Inflow
Alt. A – Outflow
Alt. D – Outflow
Alt. A – Elevation
Alt. D – Elevation
New Capabilities

- Period average flow limit criteria
- If-then-else
- User-scripted State Variables
- User-scripted Rules
- Report Builder

- Outlet Outages
- Release Allocations
- System Hydropower
- Pump-back Storage
New option for flow limit goals as **daily** or **weekly** period averages

Fluctuating flows are allowed for intervals within period, but period average requirement is satisfied
IF-THEN-ELSE

- Operational constraints with conditional statements
- Compound conditions
- Nested if-then-else

current inflow < 85% of Average
Or current inflow < 50 cms

current inflow > 85% of Average
And current inflow < 120% of Average

current inflow > 120% of Average
And current Date > 20 Mar 2005
And current Date < 15 Apr 2005
State Variable

- User-defined variable whose value ResSim computes by executing a *user-created script* at every time step throughout the simulation period.

- Computation of non-standard model variables, such as:
  - Basin wetness
  - Drought level
  - System storage

- Scripting in Jython using an editor with access to standard ResSim model variables and methods.
State Variable Editor

Script Pane (editor window)

Object Pane (API window)

API preview bar
User-Scripted Rule

- A rule that can be added and prioritized in a certain operation set

- Defining complex criteria that depends on various parameters, conditions, and special calculations

- Scripting in Jython using an editor with access to standard objects for ResSim model variables and methods
Scripted Rule Editor

Object API Item

Object API text

network.getTimeSeries("Reservoir","Thurmond","Pool","Elev")
from hec.rss.model import OpRule
from hec.rss.model import OpValue

def runScript(currentRule, network, currentRunTimeStep):
    # create new Operation Value (OpValue) to return
    opValue = OpValue()

    # set the type and value of the OpValue
    inflowTS = network.getTimeSeries("Reservoir", "Friant", "Pool", "Flow-IN")
inflow = inflowTS.getCurrentValue(currentRunTimeStep)

    if inflow > 5000:
        opValue.init(OpRule.RULETYPE_SPEC, inflow)
    else:
        opValue.init(OpRule.RULETYPE_MAX, 5000)

    # return the OpValue
    return opValue
Outlet Outages

- Capacity Override factor (0.0-1.0)
- Maintenance or offline schedule
- Repeatable outage interval
  - None
  - Daily
  - Weekly
  - Monthly
  - Yearly

Outlet Capacity Override Schedule Example:

- Outlet: Power Plant
- Date: 11 Jul 2005
- Time: 0800
- Date: 30 Sep 2005
- Time: 1700
- Capacity Factor: 0.000
- Repeat: None
- Note: Retrofitting Power Plant
Release Allocations

- Allocation options for releases across multiple outlets:
  - **Balanced** releases across multiple outlets
    
    (*weighted distribution of releases*)
  - **Sequential** operation of outlets
    
    (*prioritized sequence of release*)
  - **Stepped** percent of allocation as function of total release
    
    (*combination of balance and sequential allocation schemes*)
System Hydropower

- Storage and energy balance to achieve system-wide targets

- System generation requirement for a group of reservoirs

![Graph showing system energy (1000 MWh) for Reservoir A, B, and C over months January to October.](image)
Pump-back Storage

- Downstream source reservoir
- Pumping criteria defined at upper reservoir
  - Target fill level
  - Daily pumping schedule
Report Builder

- User-defined reports
- Time-series catalog & filter
- Column, row, & report block builder
- Column math operation & summary statistics
Recap of Enhancements

- Additional power and flexibility for defining reservoir operating criteria
- Extra control for outlet release allocations
- Expanded hydropower capabilities for system generation and pump-back operation
- User-defined Reports

Version 3.0 Public Release ~ Winter 2005
Contacts

- Joan Klipsh, HEC-ResSim Program Manager
  Water Management Systems Division, HEC
  Joan.D.Klipsh@usace.army.mil

- Fauwaz Hanbali, Hydraulic Engineer
  Water Management Systems Division, HEC
  Fauwaz.U.Hanbali@usace.army.mil

HEC Website http://www.hec.usace.army.mil