



CADSWES

University of Colorado

Center for Advanced Decision Support for Water and Environmental Systems

USACE – Overview of Modeling Approach and Enhancements

RiverWare User Group Meeting
February 10-11th, 2010

David Neumann

Outline

- Summary of methods and how they work together
- New functionality
- Upcoming Work

Overview

- Methods and rule functions are used to replace the approach used by USACE in the SUPER program

- Forecast Inflows
- Flood Control
 - Surcharge Release
 - Regulation Discharge
 - Flood Control Releases

- Conservation Operations
 - Low Flow / Demand Releases
 - Reservoir Diversions
 - Reach Diversions
- Hydropower

Forecast Inflows

- Inflows are specified as cumulative values
- RiverWare needs incremental values
- At beginning of each timestep
 - Forecast cumulative inflows throughout the forecast period
 - Calculate incremental inflows for each timestep in forecast period

Surcharge

- Mandatory releases made regardless of downstream channel constraints
- Pool elevation exceeds top of the flood pool
- Ensures safety of the structure

Rule: Set Surcharge Release Flag (S) on Res.Outflow slot of each Reservoir in Computational Subbasin

Simulation: Surcharge releases and Outflows are computed and set by the resulting dispatch method for entire forecast period

Regulation Discharge

- Methods determine the maximum flow permitted at the control point and empty space available in the channel based on the current flow

Rule: Set Regulation Discharge (G) Flag on all Control Point.RegDischargeCalc slots

Simulation: Calculate Regulation Discharge and dependent methods; removes G flag; does not reset any Outflows

Flood Control

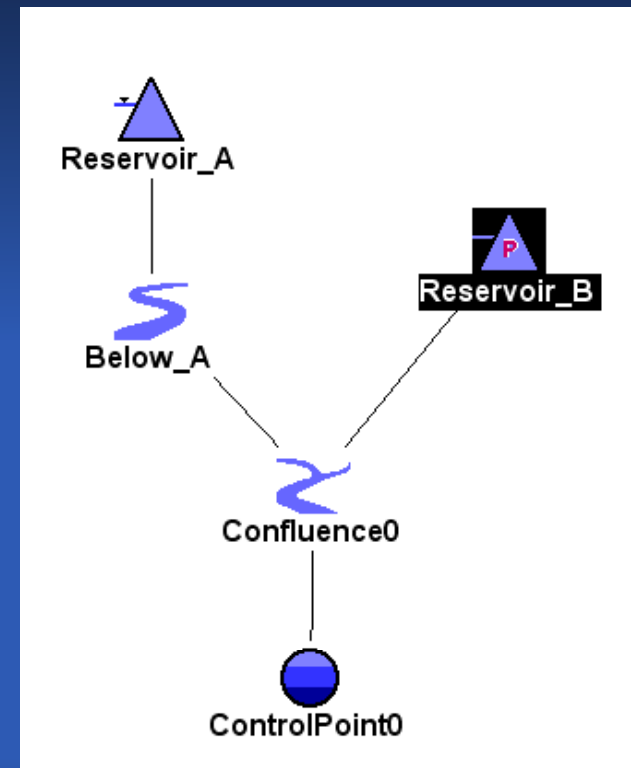
- Determine additional flood control releases for each reservoir in the subbasin
- Respect downstream channel constraints
- Balance reservoir storages to extent possible

Rule: FloodControl(): Function executes Flood Control Method on subbasin and the calling rule sets
Reservoir.FloodRelease and Res.Outflow on subbasin
(outflow = surcharge release + flood release)

Simulation: Objects dispatch and results propagate downstream

Conservation Operations: Low Flow / Demand Releases

- Flow requirement on a Control Point represents environmental flows or demand
 - Determine releases to meet a downstream flow requirement
 - Reservoirs are considered in the order of highest operating level
- Rule: MeetLowFlowRequirement():** Execute Low Flow Release Method on computational subbasin and rule sets reservoirs Low Flow Release slots and Outflow slots
- Simulation:** Objects dispatch and results propagate downstream

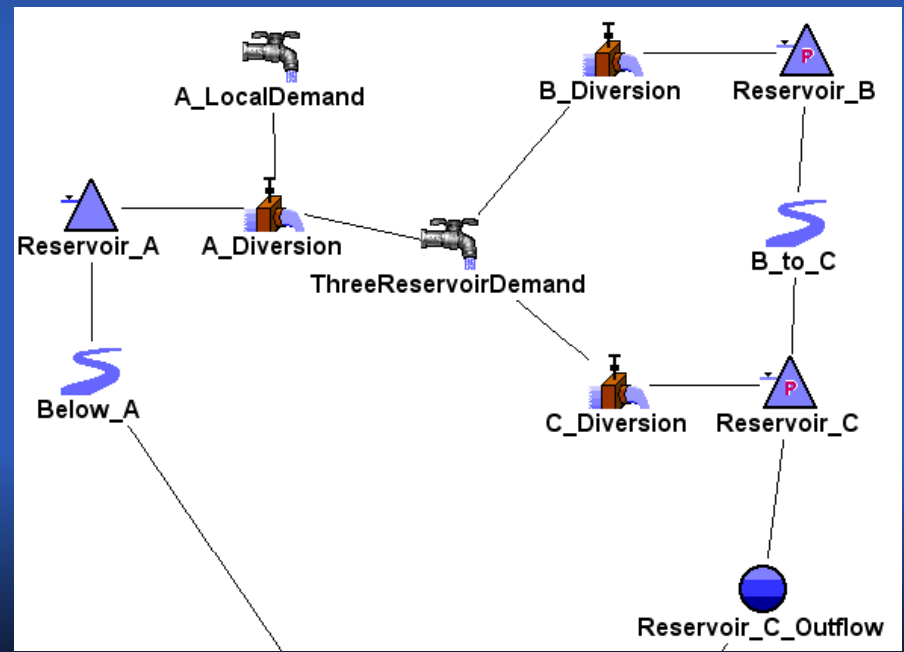
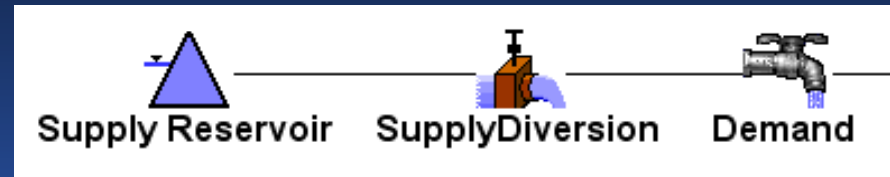


Conservation Operations: Reservoir Diversions

- Water is diverted directly out of a reservoir to meet demands
- Modeled using a Diversion and Water User
- One reservoir can meet many demands
- A demand can be served by many reservoirs

Rule: ComputeReservoirDiversions():
Execute method on subbasin and set Water Users' Incoming Available Water subslots and Diversion objects' Multi Outflow slots

Simulation: Reservoirs, Water Users, and Diversion objects dispatch.



Hydropower

- Make releases to meet energy demand
 - Cannot draw below min power pool or exceed max drawdown
 - Cannot cause additional downstream flooding

Rule: HydropowerRelease(): Prioritizes the reservoirs by relative energy shortage.

- Loops through each reservoir in the basin and calculates the proposed release to meet the demand.
 - Calculates portion of the proposed release that will not cause additional downstream flooding.
 - Rule sets Res.Outflow
- **Simulation:** Objects dispatch simulating the effects of the release.

How does this all work together:

- Rules execute in following order once per ts:
 - Forecast and compute incremental Local Inflows
 - Surcharge Release } Mandatory Releases
 - Regulation Discharge } Find Empty Space
 - Flood Control Releases } Additional Flood Releases
 - Low Flow / Demand releases } Increase Outflow
 - Reservoir Diversions } Divert water from Res.
 - Hydropower } Increase Outflow
 - Note, reach diversions and losses happen as objects dispatch.

Recent Enhancements

- Performance work
- Export/Import plot configurations
- Clear values imported by DMI
- Global plot config to put elevation on y-axis
- Extended riverwareDB for data objects
- User Guide for USACE methods