



CADSWES University of Colorado

Center for Advanced Decision Support for Water and Environmental Systems

Multiple Run Management

RiverWare User's Group Meeting
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MRM Modes

- Two main modes – Concurrent and Iterative
- Concurrent mode is frequently used for policy studies
 - The inputs are known in advance
 - The number of simulations is known in advance
- Iterative mode is used for iterative solutions
 - The number of simulations is not known in advance – it's determined by the state of the system after each simulation
- Output is RiverWare Data Format (RDF) file

Concurrent MRM

- All simulations have the same start and finish dates
- Define multiple simulation runs by specifying multiple inputs
- Inputs include rulesets, input DMIs and index sequential (rotating time series data)
- RiverWare runs the resulting simulations
- Output is RiverWare Data Format (RDF) file

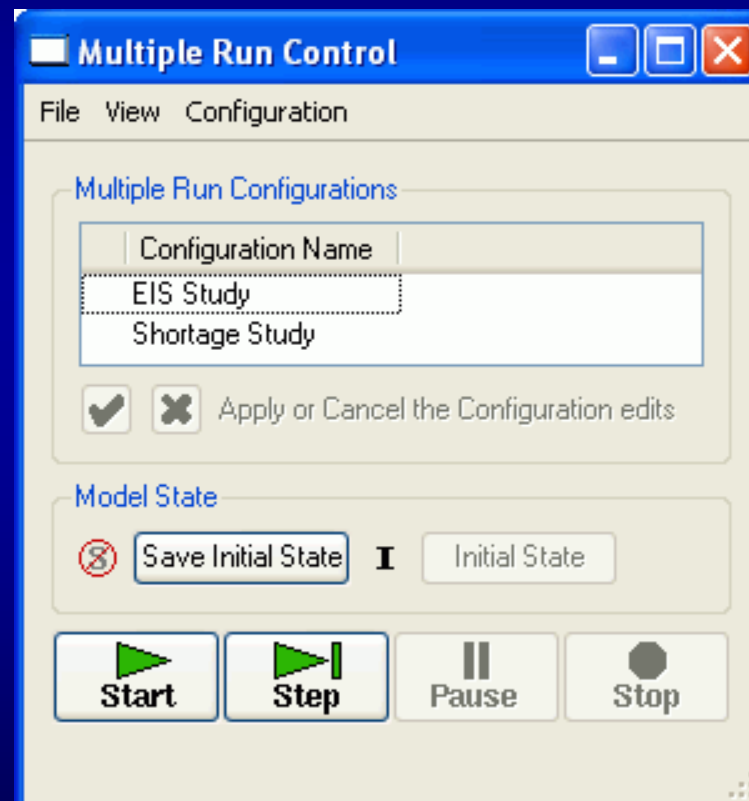
Concurrent MRM

➤ Simple example:

- A policy study might include three rulesets (expressing the proposed policies) and five input DMIs (representing the hydrologic scenarios to evaluate the policies)
- RiverWare would run the fifteen resulting simulations

MRM Configuration

- Manage multiple named configurations
- Run selected configuration



MRM Configuration

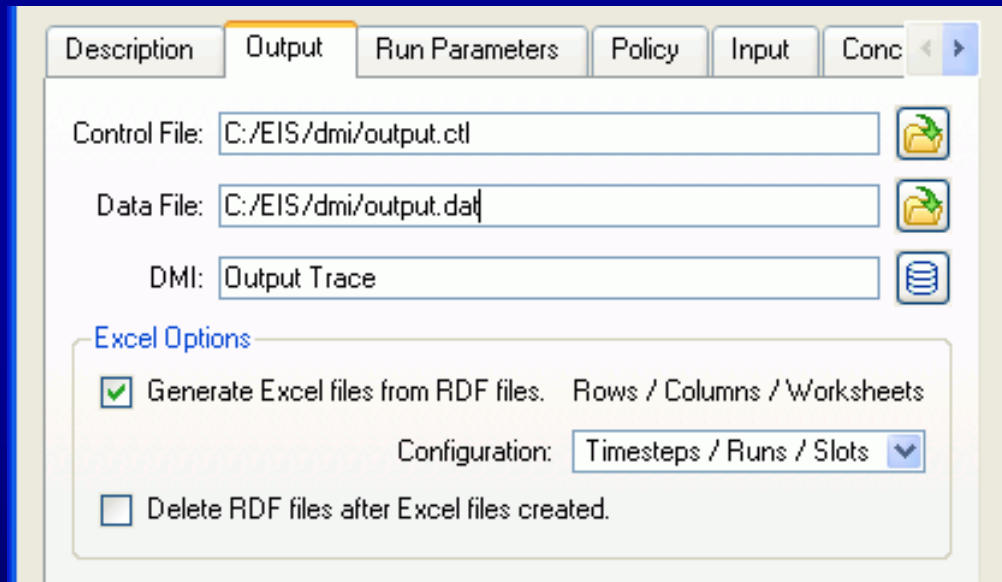
Specify:

- Configuration name
- Configuration mode
- Inputs being provided (with a dialog tab displayed for each)

The screenshot shows a dialog box titled "MRM Configuration - EIS Study". The "Configuration" section includes a "Name" field with "EIS Study" and a "Mode" dropdown menu set to "Concurrent". The "Policy" section has three radio buttons: "None", "Rules" (selected), and "Constraints". The "Input" section has two checked checkboxes: "Input DMIs" and "Index Seq.". Below these sections are six tabs: "Description", "Output", "Run Parameters", "Policy", "Input", and "Concurrent Runs". The "Description" tab is active, showing an empty text area. At the bottom are "OK", "Apply", "Reset", and "Cancel" buttons.

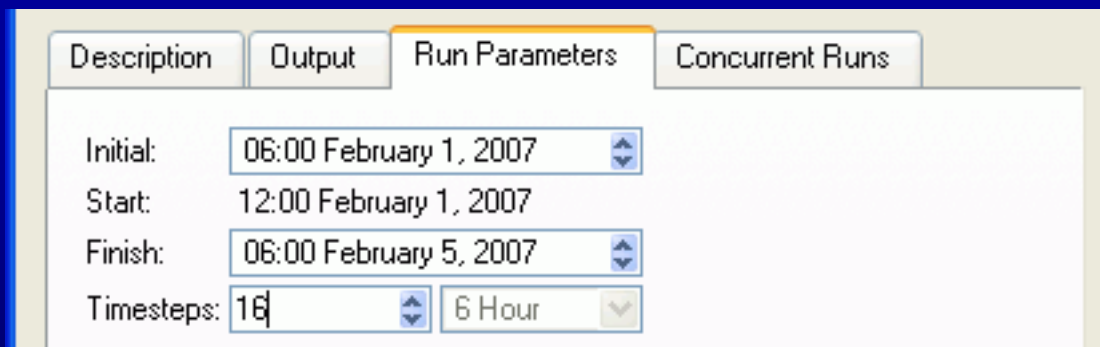
MRM Configuration

- Control file specifies slots written to RDF file
- Data file specifies RDF file
- Output DMI invoked after each simulation run
- On Windows generate Excel directly (otherwise use ExcelWriter)



MRM Configuration

- Specify the run parameters (excluding the timestep)

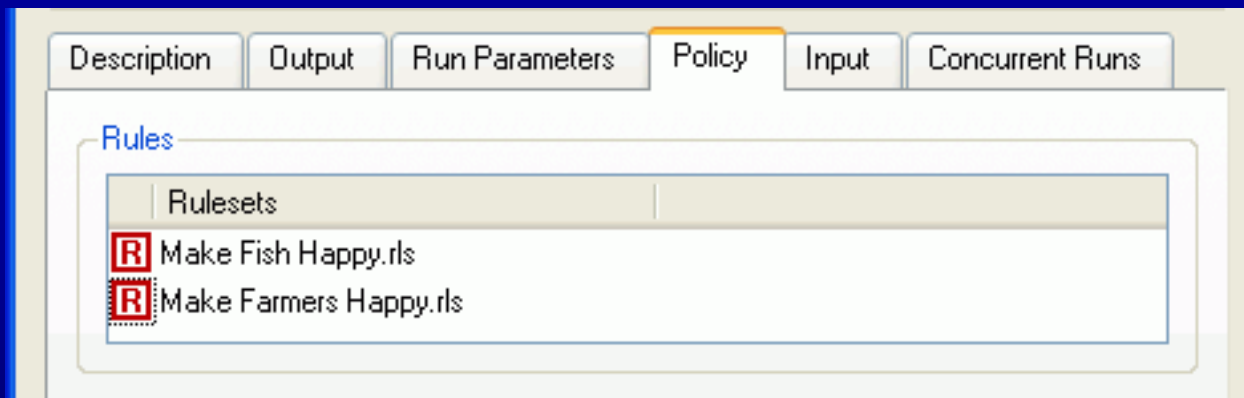


The screenshot shows a dialog box with four tabs: Description, Output, Run Parameters, and Concurrent Runs. The Run Parameters tab is selected. It contains the following fields:

Initial:	06:00 February 1, 2007	
Start:	12:00 February 1, 2007	
Finish:	06:00 February 5, 2007	
Timesteps:	16	6 Hour

MRM Configuration

- Specify the rulesets expressing the policies



MRM Configuration

- Specify input DMIs and repeat counts
- Specify index sequential parameters – number of runs, initial offset (applied before first run), interval (applied before subsequent runs) and control file (identifying slots to rotate)

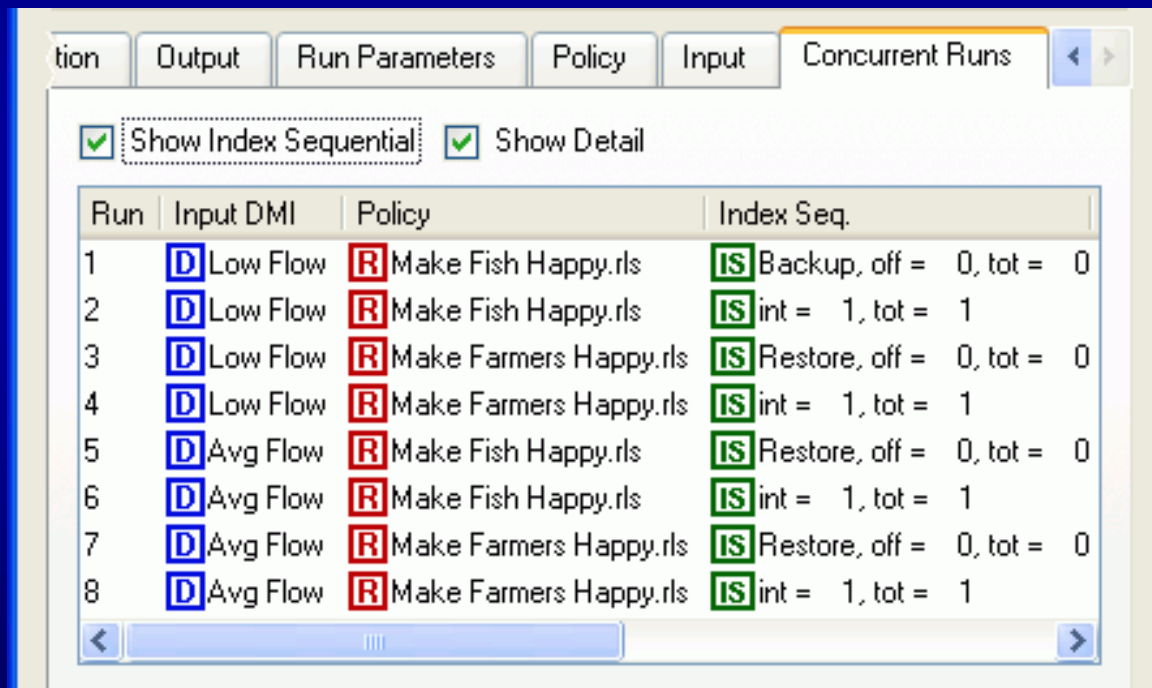
The screenshot shows the 'Input' tab of the MRM Configuration dialog. It features two main sections: 'Input DMIs' and 'Index Sequential'. The 'Input DMIs' section contains a table with two rows: 'Low Flow' and 'Avg Flow', each with a 'Repeat' count of 1. The 'Index Sequential' section includes fields for 'Number of Runs' (2), 'Initial Offset' (0), and 'Interval' (1). It also has radio buttons for 'Timesteps' (selected) and 'Years'. A 'Control File' field is set to 'rotate.ctl'. At the bottom, there are radio buttons for 'Combinations' and 'Pairs'.

Repeat	DMI
1	Low Flow
1	Avg Flow

























Index Sequential / DMI Mode: Combinations Pairs

MRM Configuration

- See the resulting runs

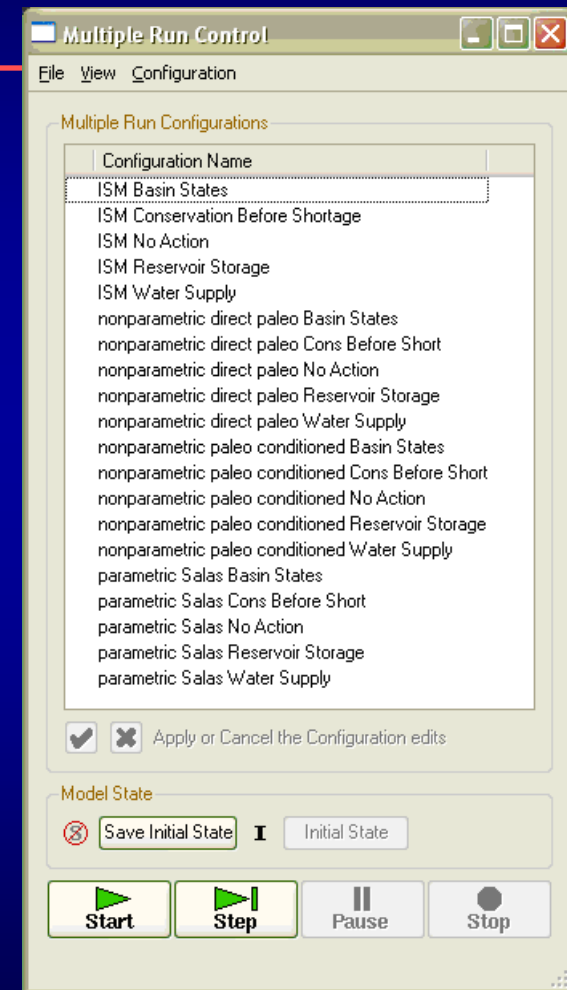


The screenshot shows the 'Concurrent Runs' tab in the MRM Configuration software. The interface includes a table with the following columns: Run, Input DMI, Policy, and Index Seq. The table lists 8 runs with various input DMIs and policies.

Run	Input DMI	Policy	Index Seq.
1	 Low Flow	 Make Fish Happy.rls	 Backup, off = 0, tot = 0
2	 Low Flow	 Make Fish Happy.rls	 int = 1, tot = 1
3	 Low Flow	 Make Farmers Happy.rls	 Restore, off = 0, tot = 0
4	 Low Flow	 Make Farmers Happy.rls	 int = 1, tot = 1
5	 Avg Flow	 Make Fish Happy.rls	 Restore, off = 0, tot = 0
6	 Avg Flow	 Make Fish Happy.rls	 int = 1, tot = 1
7	 Avg Flow	 Make Farmers Happy.rls	 Restore, off = 0, tot = 0
8	 Avg Flow	 Make Farmers Happy.rls	 int = 1, tot = 1

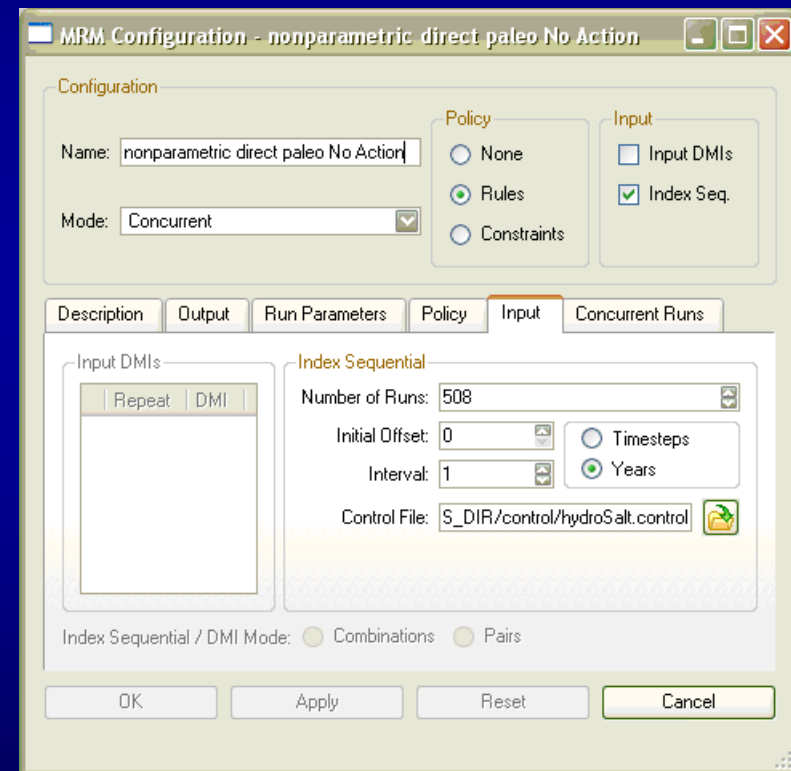
Recent MRM Implementation

- 5 proposed policies
- 4 hydrologic inflow scenarios
 - ISM based (Ouarda et al., 1997)
 - Historic flow (1906-2004)
 - 99 traces
 - Paleo flow (1490-1997)
 - 508 traces
 - Input DMI and ISM based
 - Paleo conditioned (Prairie, 2006)
 - 125 traces
 - Parametric stochastic (Lee et al., 2006)
 - 100 traces



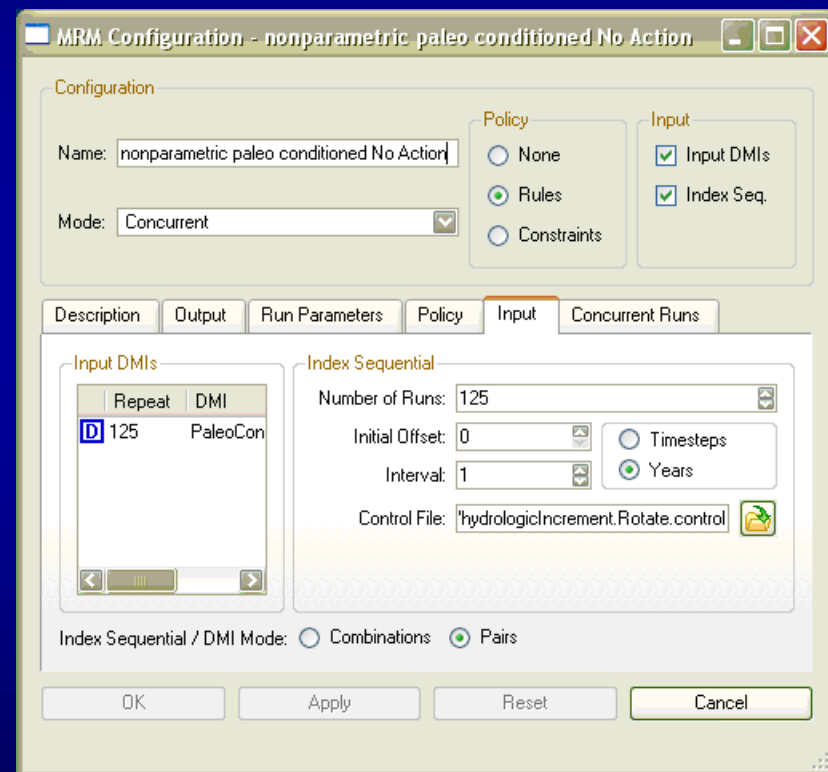
ISM stochastic technique

- Sequentially resamples blocks of flow data
- Can only produce
 - Observed flow magnitudes
 - Observed flow sequences
- Easily generates data for mutli-site model
- Easily preserves observed data statistics



Alternate Stochastic Techniques

- Paleo conditioned
 - Combines observed and paleo streamflows
 - Generates
 - Observed flow magnitudes
 - Paleo-like flow sequences
- Parametric
 - Fit observed data to appropriate model (i.e., CAR)
 - Generates
 - Flow magnitudes not observed
 - Observed-like flow sequences

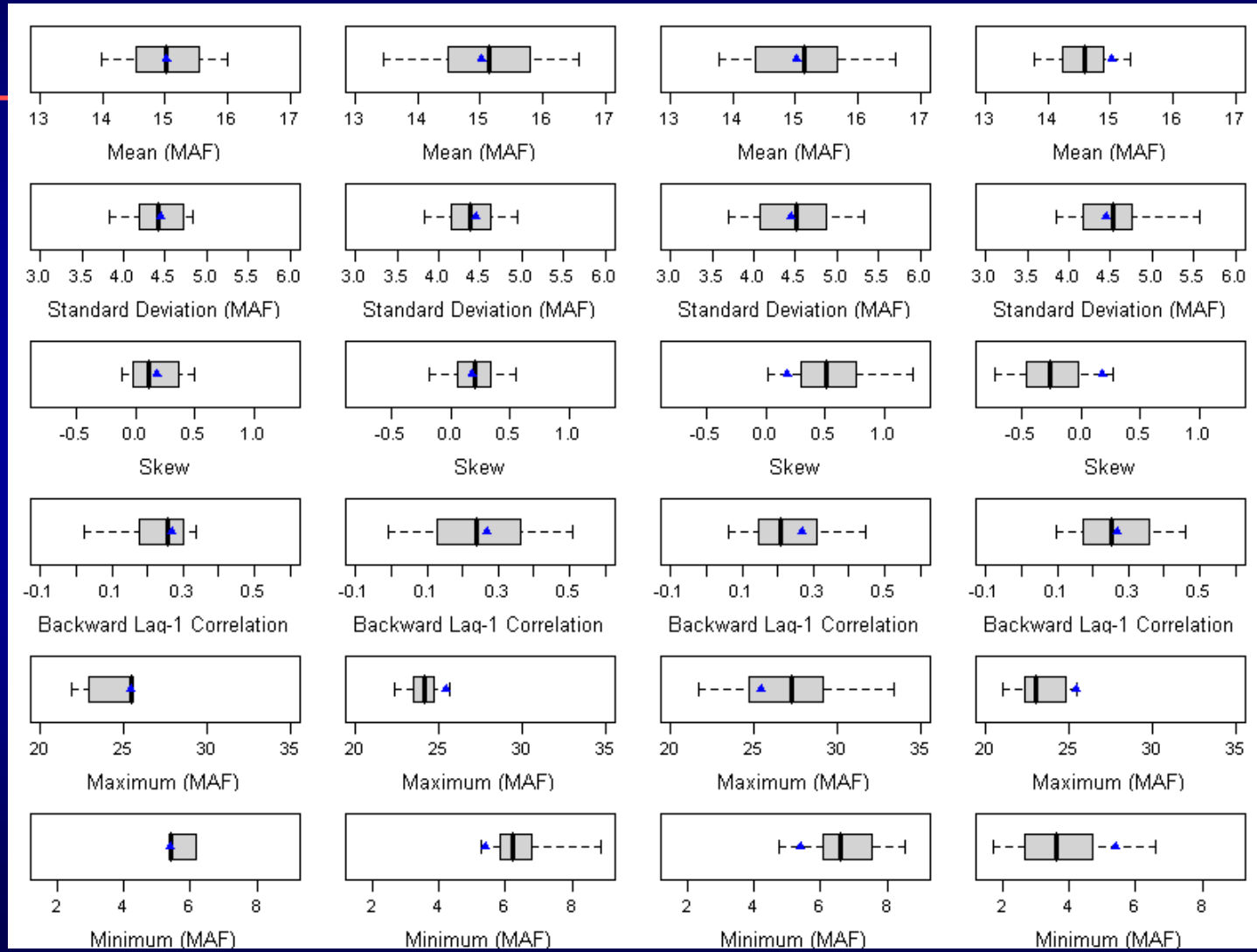


Observed ISM

Paleo conditioned input DMI

Parametric input DMI

Direct Paleo ISM



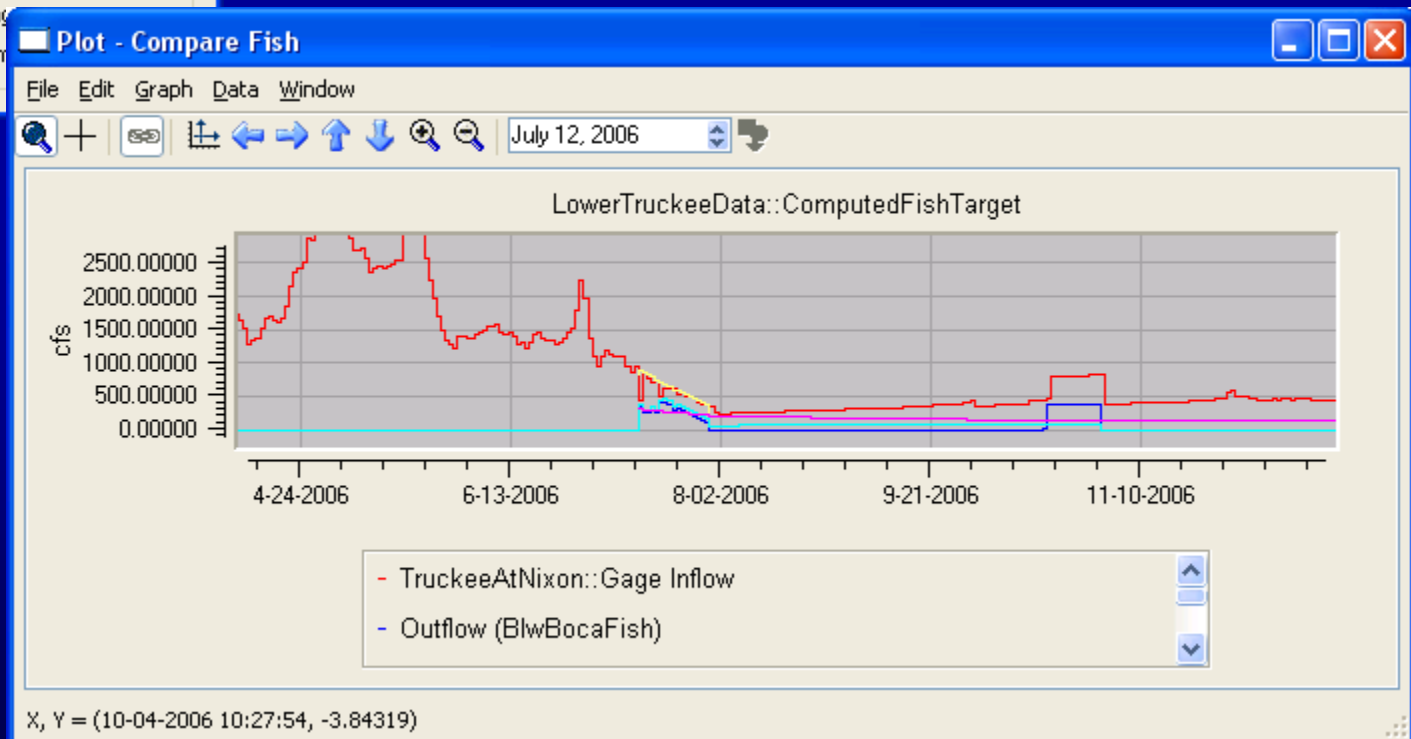
Iterative (RPL-controlled) MRM

Run Status

Multiple Run Status
Current run 1

Single Run Status
100%

Execution State: Running
Current Timestep: Decem



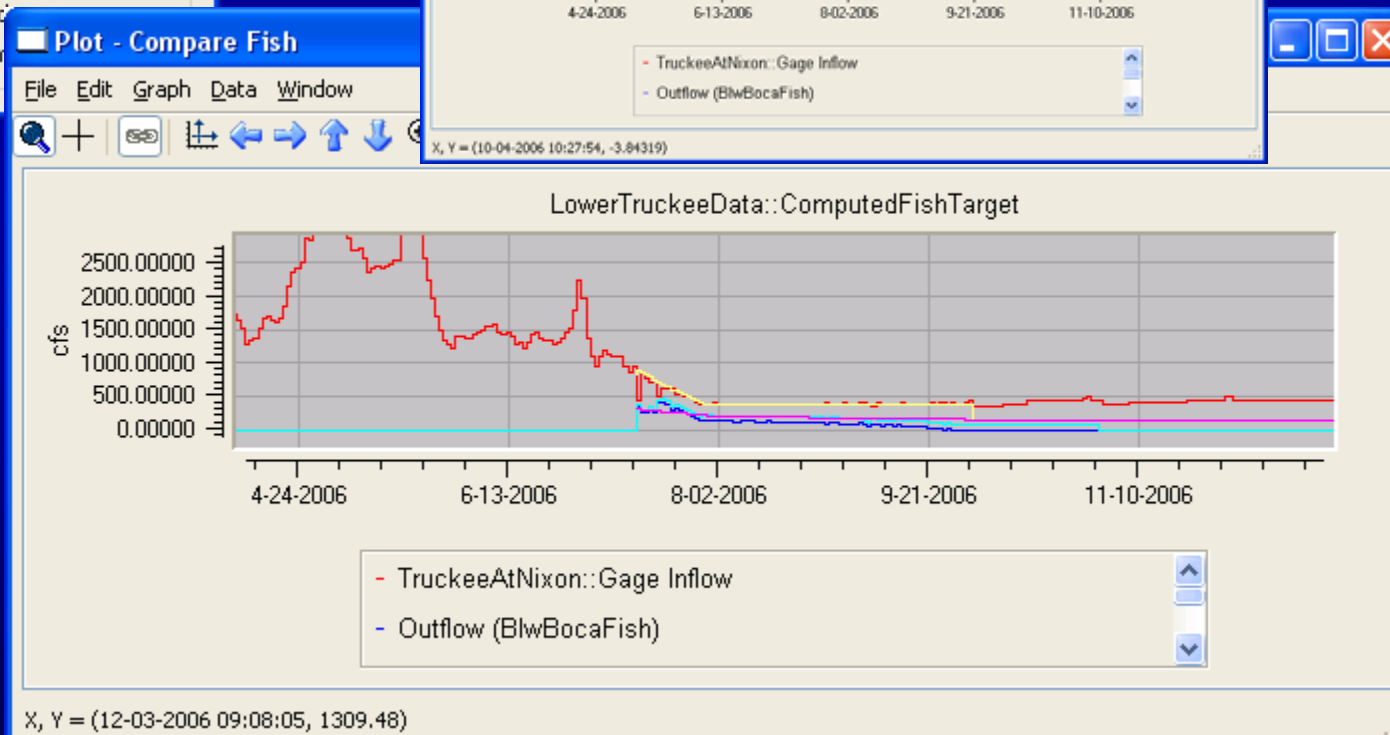
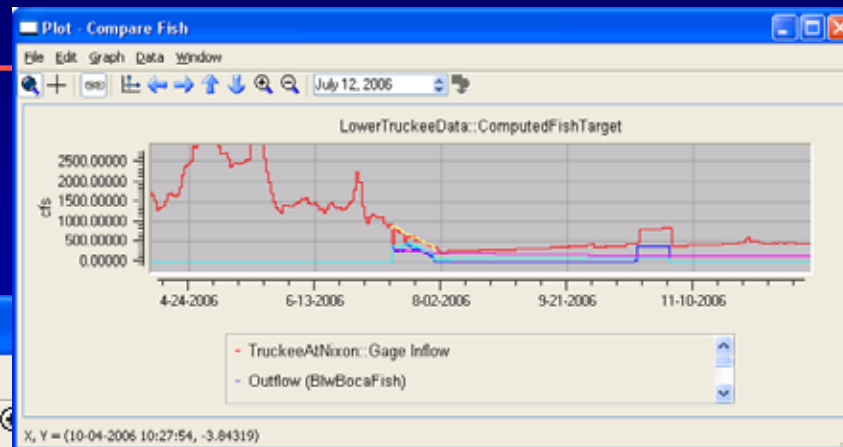
Iterative (RPL-controlled) MRM

Run Status

Multiple Run Status
Current run 2

Single Run Status
100%

Execution State: Finished
Current Timestep: Decem



Iterative (RPL-controlled) MRM

The image shows two overlapping software windows. The main window is titled "MRM Configuration - Iterative Configuration". It has a "Configuration" section with fields for "Name" (Iterative Configuration), "Mode" (Iterative), "Policy" (None, Rules, Constraints), and "Input" (Input DMIs, Index Seq.). Below this are tabs for "Description", "Output", and "Iterative Runs". The "Iterative Runs" tab contains a table of MRM Rules, a "Continue After Abort" checkbox, and a "Max Iterations" field set to 3. The "RBS Ruleset Editor - 'MRM Rules'" window is overlaid on the right, showing a tree view of rules with columns for Name, Priority, On, and Type.

Initialization Rule	Priority	Post-Simulation Rule	Priority
Assign_SomeInitialValues	5	ExcessStorage_Reassignment	2
		MonteCarloRandomNumber	4

Name	Priority	On	Type
Demonstration_RulesGroup-01		✓	Policy G...
Assign_ExpressionCalculatedValueToSlot	1	✓	Rule
Assign_ExpressionCalculatedValueToSlot_atFinishTimestep 2	2	✓	Rule
Assign_ExpressionCalculatedValueToSlot_Various	3	✗	Rule
Assign_MonteCarloRandomNumber	4	✓	Rule
Demonstration_RulesGroup-02		✓	Policy G...
Assign_SomeInitialValues	5	✓	Rule

Iterative (RPL-controlled) MRM

An iterative run executes as follows:

- Initialize the iteration count.
- Execute the initialization rule(s), if specified.
- Perform the simulation run.
- Execute the post-simulation rule(s), if specified.
- If the post-simulation rule(s) return “no change”, that is they do not assign one or more new (different) values, the iteration is complete.
- Otherwise, the iteration count is checked. If it equals the maximum number of iterations specified, then the iteration is complete also.
- If the iteration is not complete, then increment the iteration count and return to step 3 above.