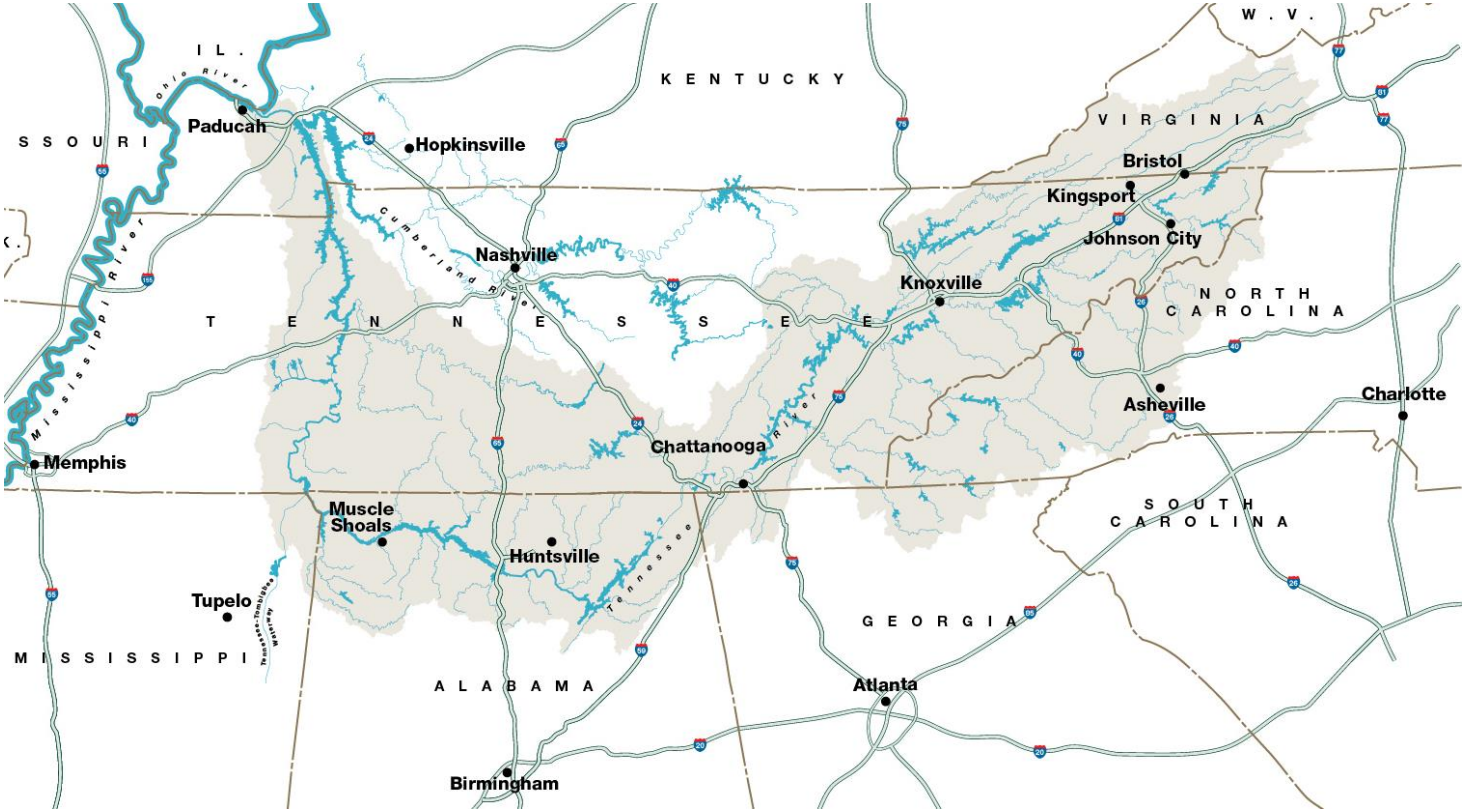
Replacing TVA's Weekly Scheduling Model with a RiverWare Long-term Model Using MRM

Gabriel Miller, P.E.

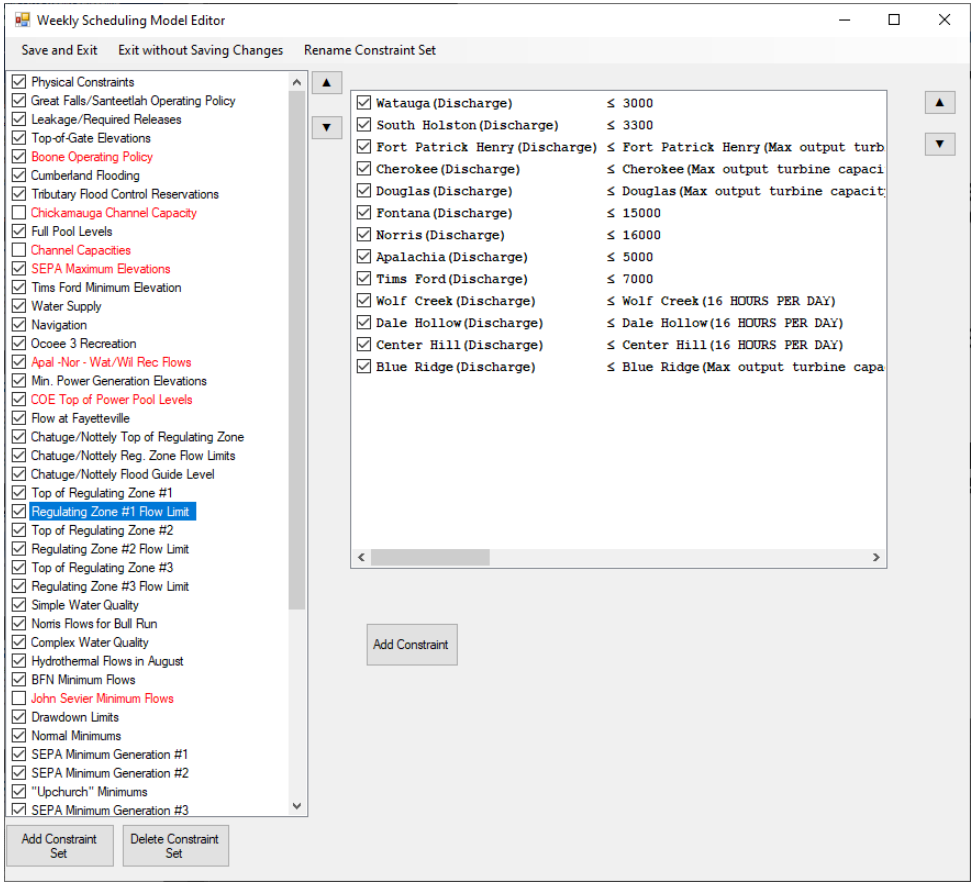
TVA TENNESSEE VALLEY AUTHORITY

Tennessee Valley Watershed



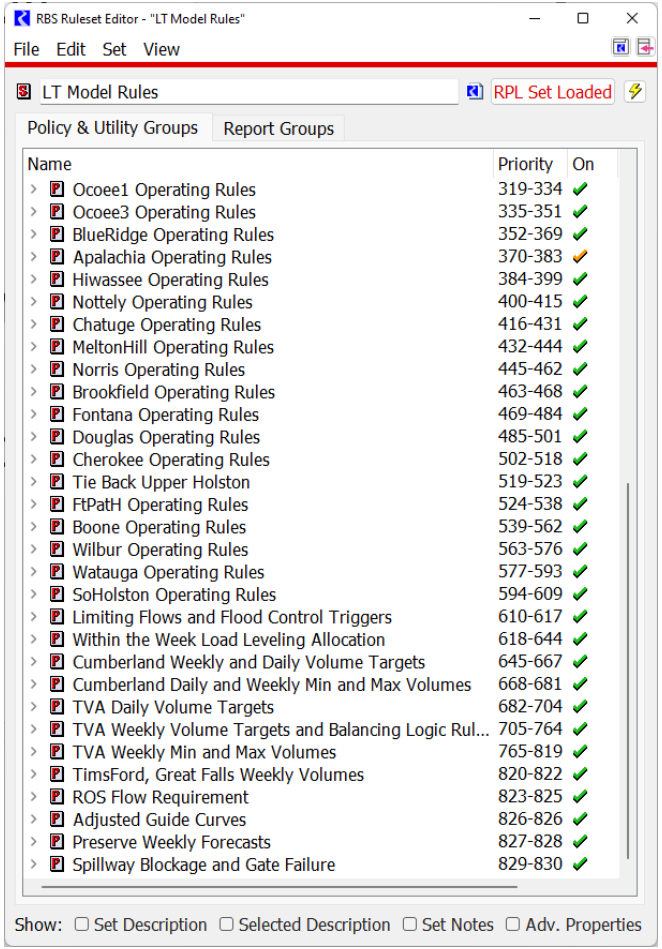
Background and Motivation

- Legacy VB/fortran long-term model built on a weekly timestep.
- Only one, mostly retired person, could maintain the old model.
- Riverware model would allow for more flexible, accurate runs



General Rule Structure

- 830 Rules!
- Weekly “pseudo-simulation” → weekly volumes
- Allocate to hourly releases to “level load”
- Aggregate to 6-hour target releases
- Apply target at each reservoir and check against high-priority requirements
- Post-process outputs specific to use case



Use Cases

- Inputs for power system models
  - Long-term: 20-30 years; 2x/year
  - Near-term: 1-2 years; every month
  - **Outputs**: monthly energy and capacity

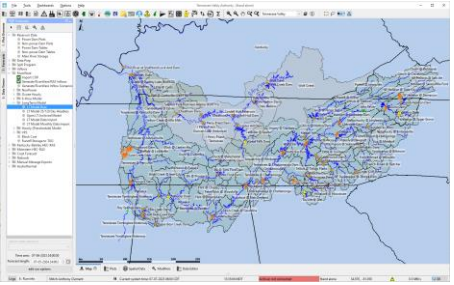
- 120-day forecast
  - Run daily
  - **Outputs**: daily elevations, flows, energy, capacity

- Outage analysis
  - Compare alternative outage schedules
  - **Outputs**: energy value delta relative to baseline

- Plant modification analysis
  - Compare alternative plant power characteristics (upgrades)
  - **Outputs**: energy and value delta relative to baseline

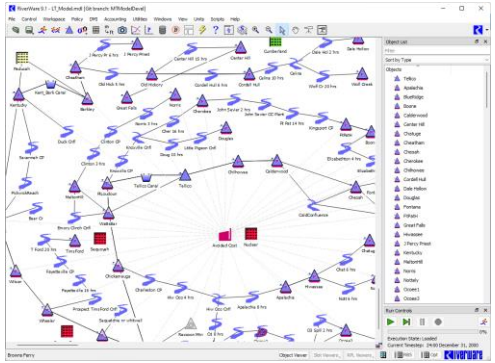
LT Model Workflow

Initialize model from FEWS

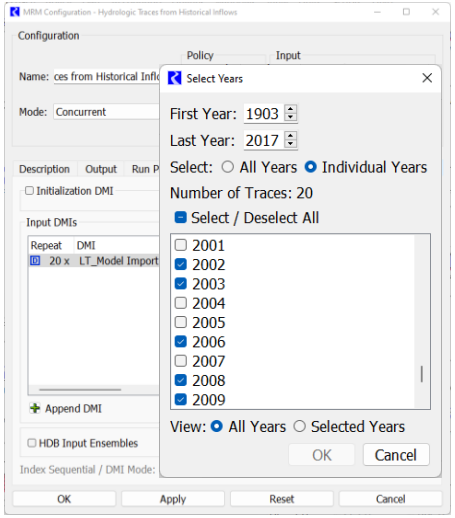


Sets Run Range

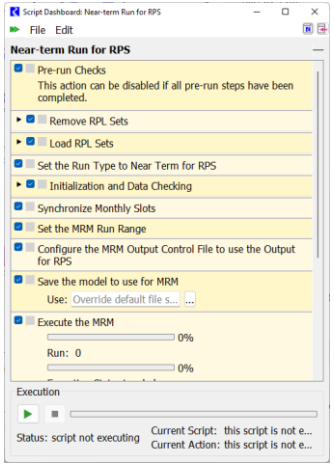
Inputs common to all runs



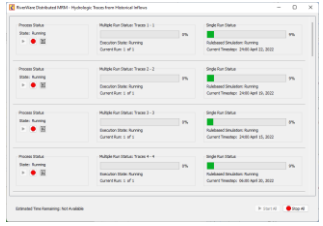
Select historical years as traces

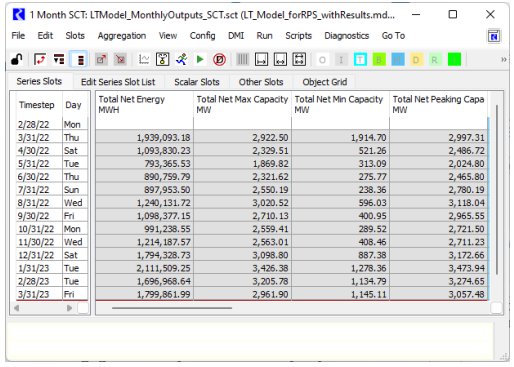


Execute script specific to use case



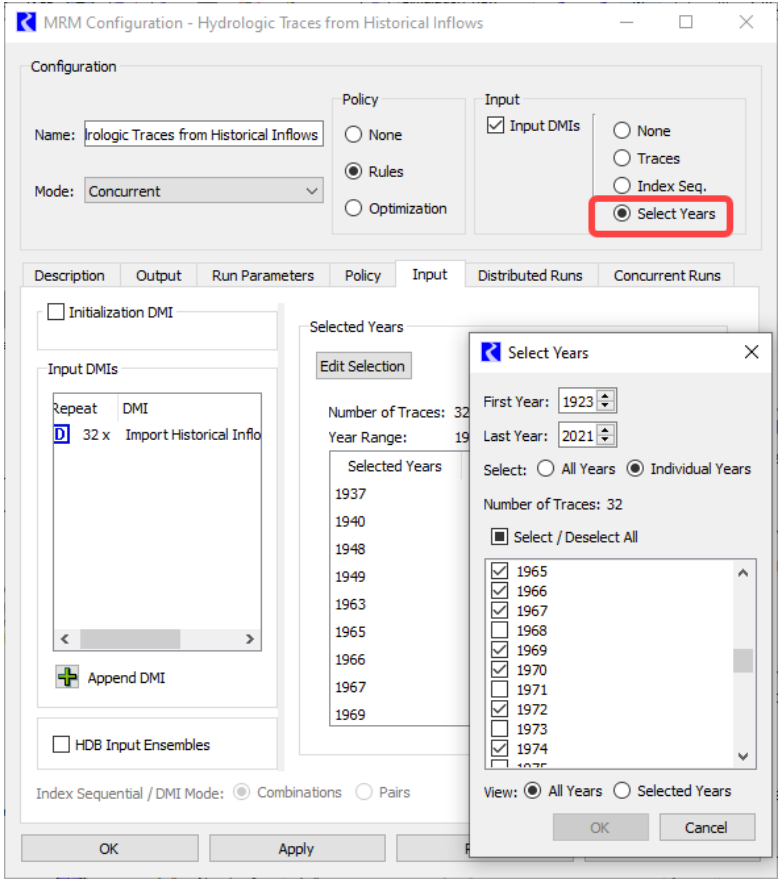
- Initialization
- Distributed MRM
- Post-process MRM results – ensemble data analysis, example: medians across traces



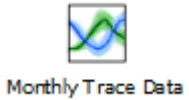


Select Hydrologic Years for Traces

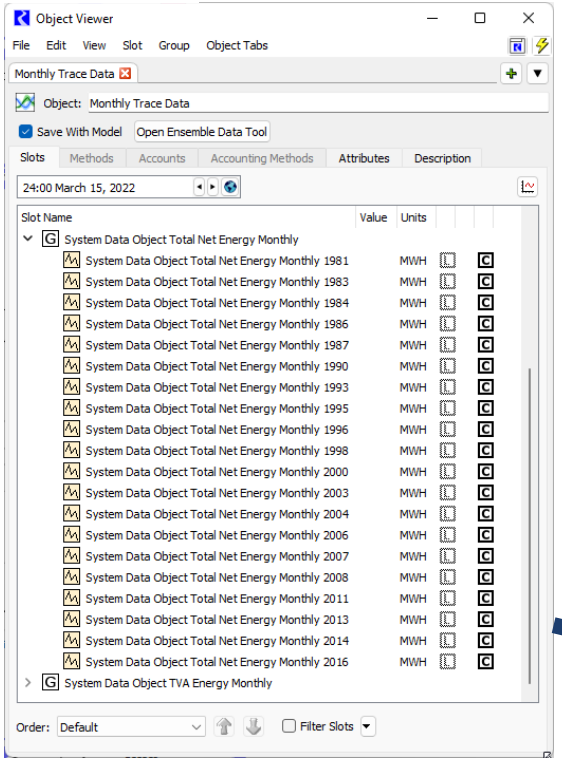
- Select hydrologic years similar to current conditions
  - New MRM Select Years Input Mode
  - Single input timeseries for each location
  - Maps to simulation years
  - Traces labeled with selected years



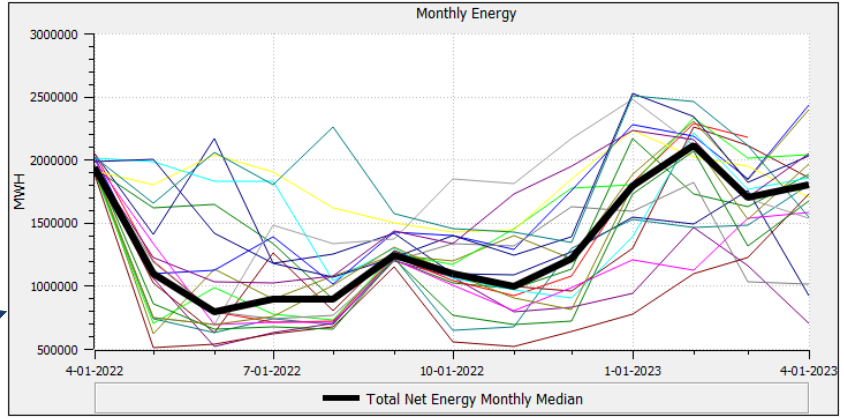
Ensemble Data Analysis Via Scripts



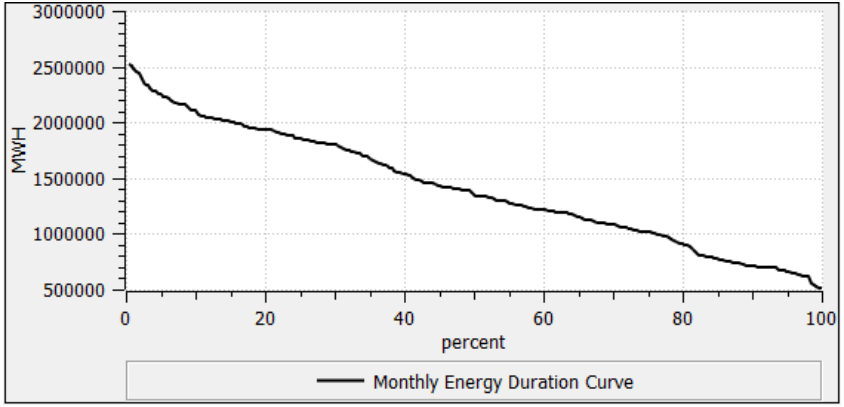
Import MRM trace results to ensemble data set



Compute median across traces
Example: Median Monthly Energy

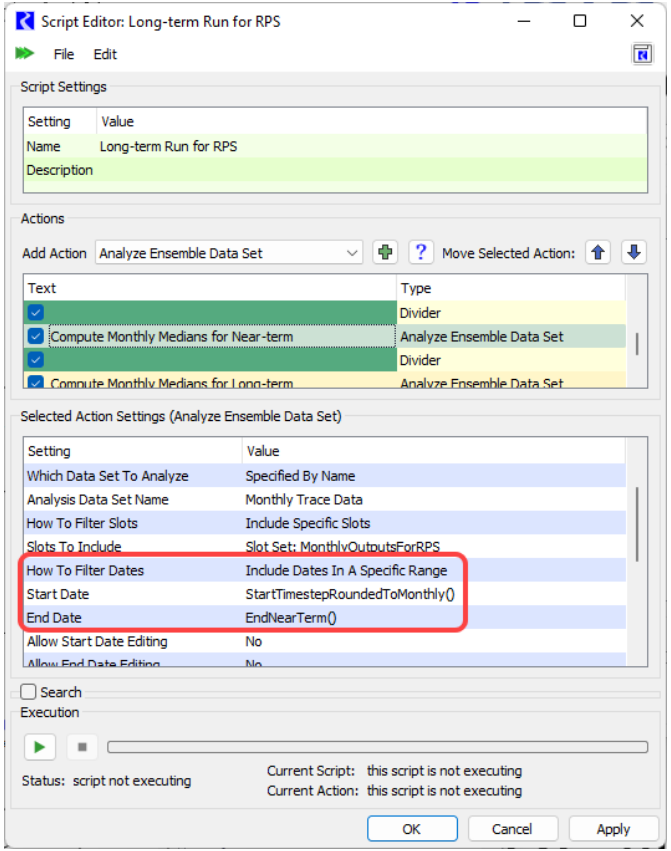


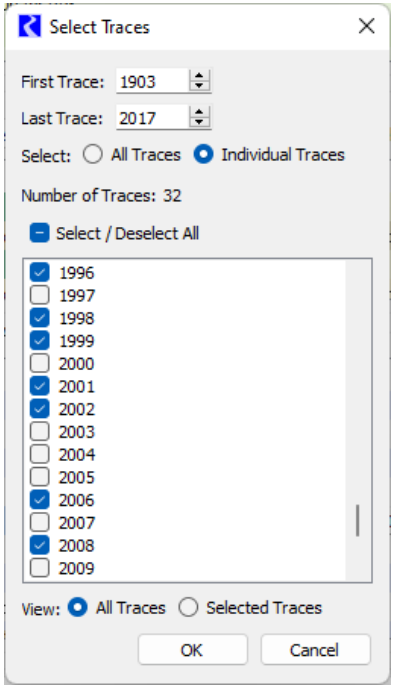
Compute duration curve across traces and timesteps



Filtering Ensemble Data Analysis: Timesteps and Traces

- Include only select traces in near-term analysis – similar years
- Include all traces in long-term analysis

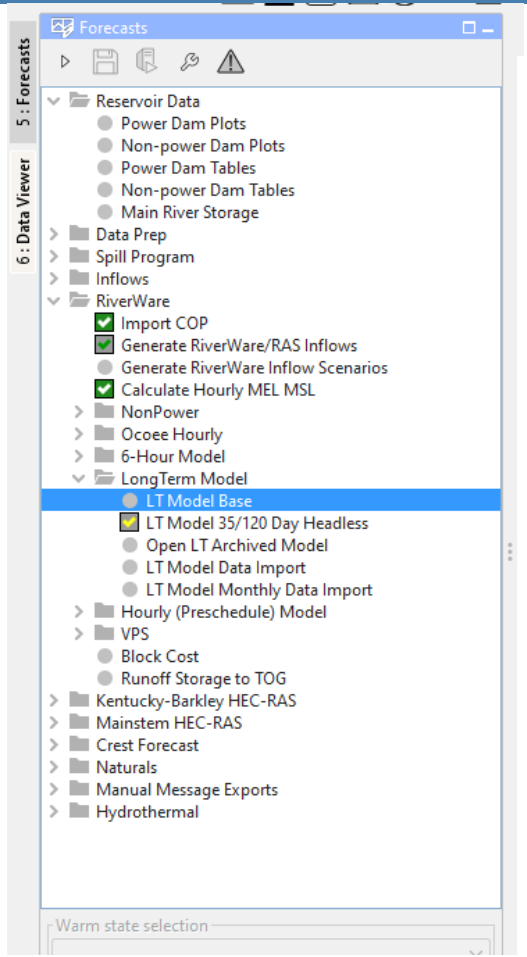




TENNESSEE VALLEY AUTHORITY

Benefits of New LT Model

- Improved model results because 6-hour timestep and better policy representation
- Common platform that our modelers and forecasters understand
- More flexibility to run special studies and modifier policy
- Better integration with FEWS/existing software.
- Can be supported



TENNESSEE VALLEY AUTHORITY


TVA
TENNESSEE
VALLEY
AUTHORITY