

RECLAMATION

Managing Water in the West

**Pisces as an input data management
and output analysis tool for
RiverWare®**

**RiverWare User Group Meeting
August 24, 2016**



U.S. Department of the Interior
Bureau of Reclamation

Typical Modeling Process

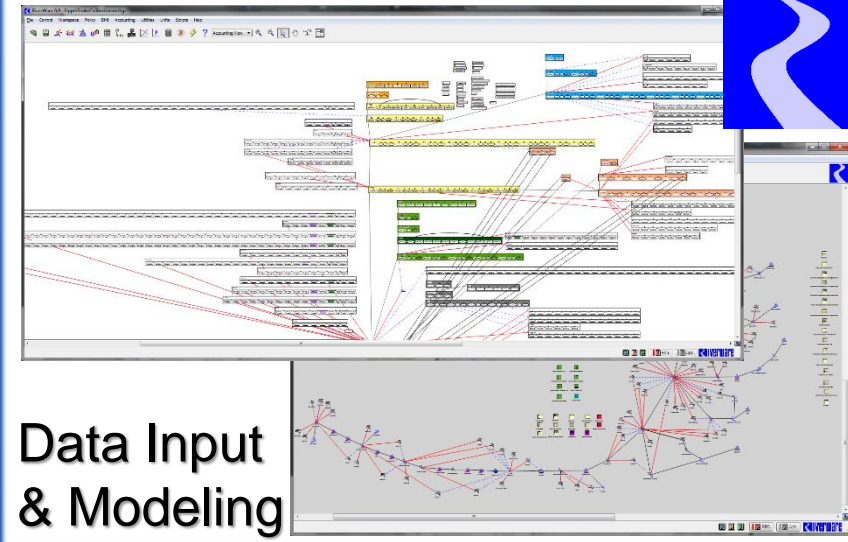
Data Collection



Data Aggregation & Processing



- Data & Layout Formatting
- Data Analysis
- Time-Step Aggregation
- Pre-processing Calculations
- QA/QC
- RW Standardization
- etc...



Data Input & Modeling



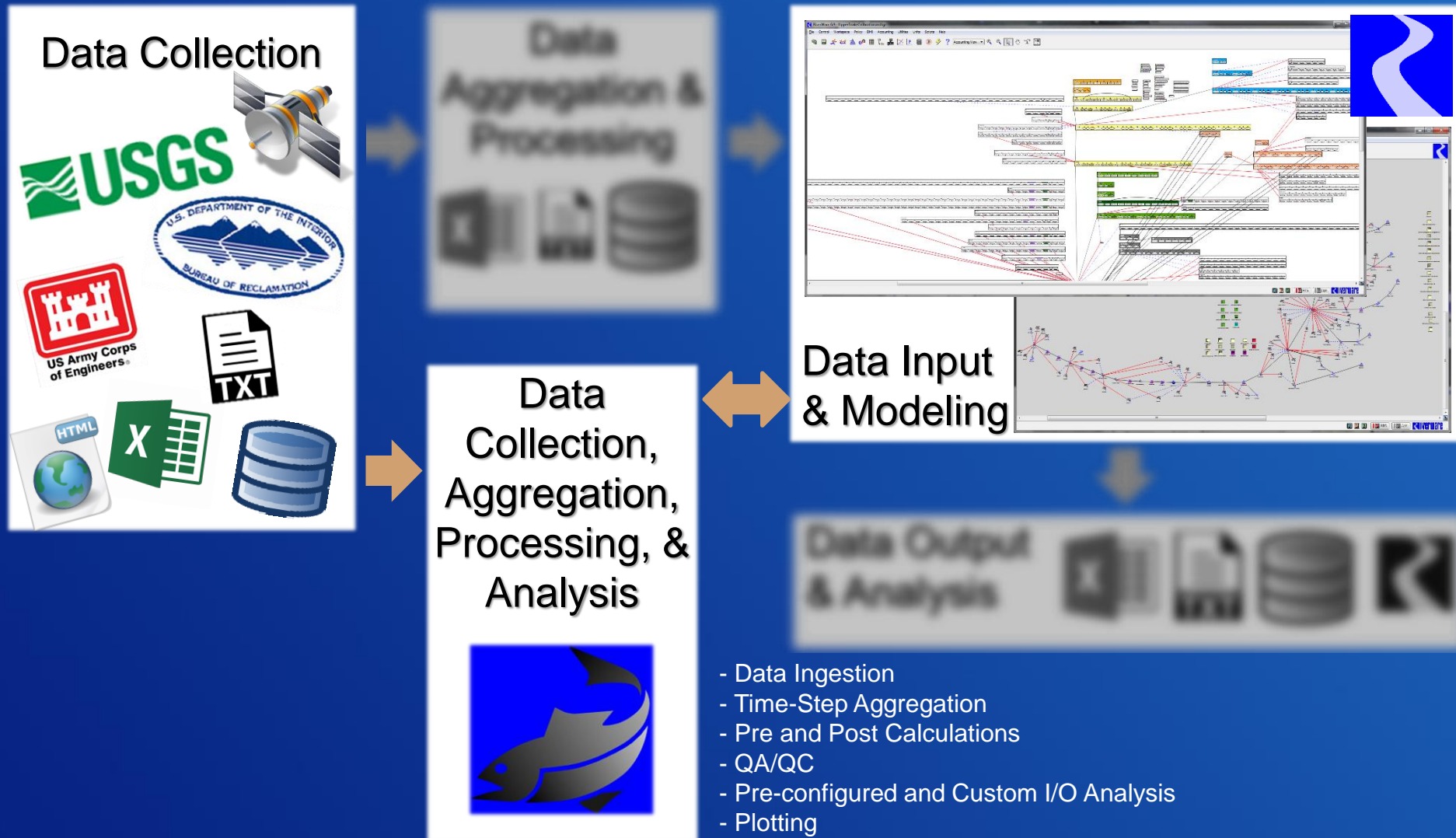
Data Output & Analysis



- Data & Layout Formatting
- Post-processing Calculations
- Output Analysis
- QA/QC
- Plotting
- etc...

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Modeling Process with Pisces



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Pisces

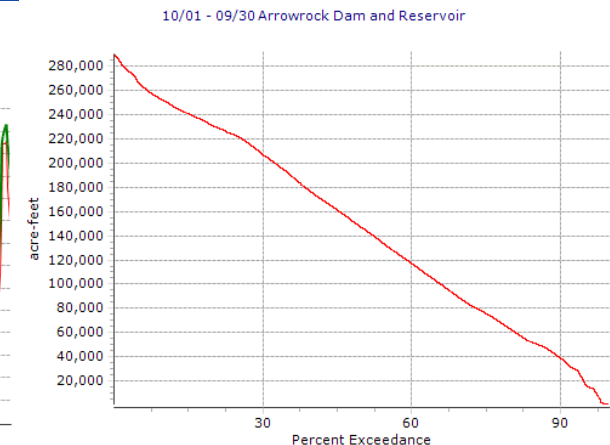
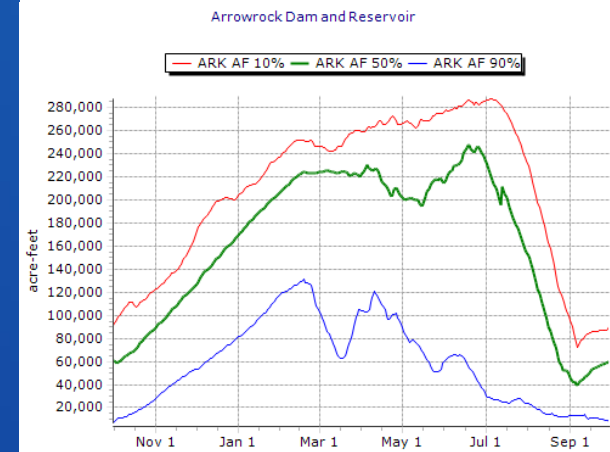
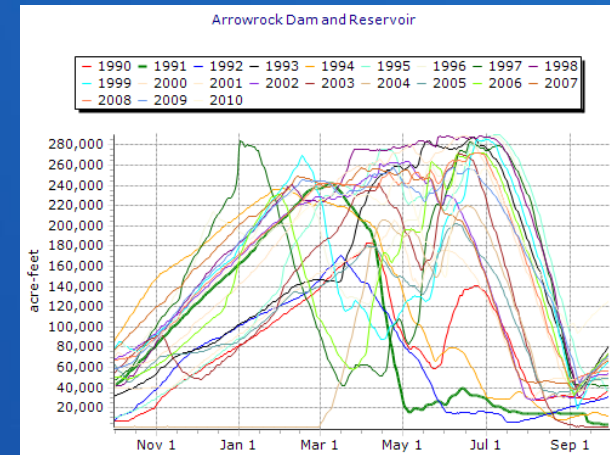
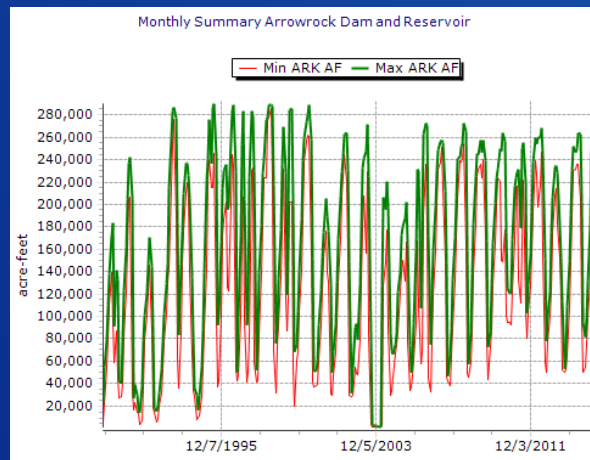
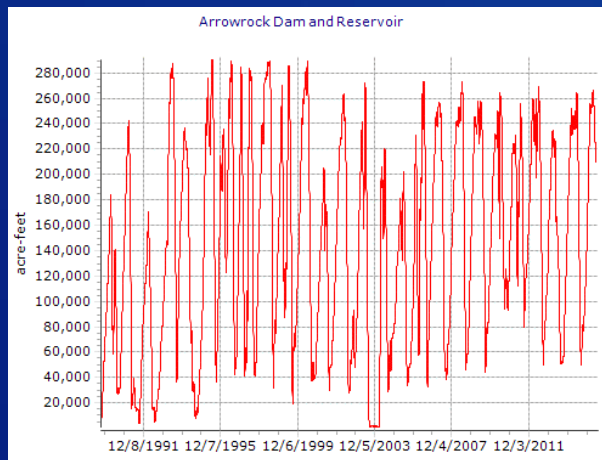
- Free and open-source software to store, organize, graph, and analyze time series data
- Relational SQL database engine
- Windows/Linux application developed in C#
- Rich time-series analysis and plotting environment

Input Data Management

- Capability to query online data from:
 - Reclamation HydroMet, AgriMet, & HDB
 - USGS NWIS
 - NRCS Snotel
 - State Water Resource Departments (OR, ID)
- Capability to read data from:
 - MS Excel, Access
 - HEC DSS
 - SHEF, CSV, TXT,
 - RiverWare RDF
- Capability to create custom data
 - Hybrid/calculated/estimated inputs using raw data

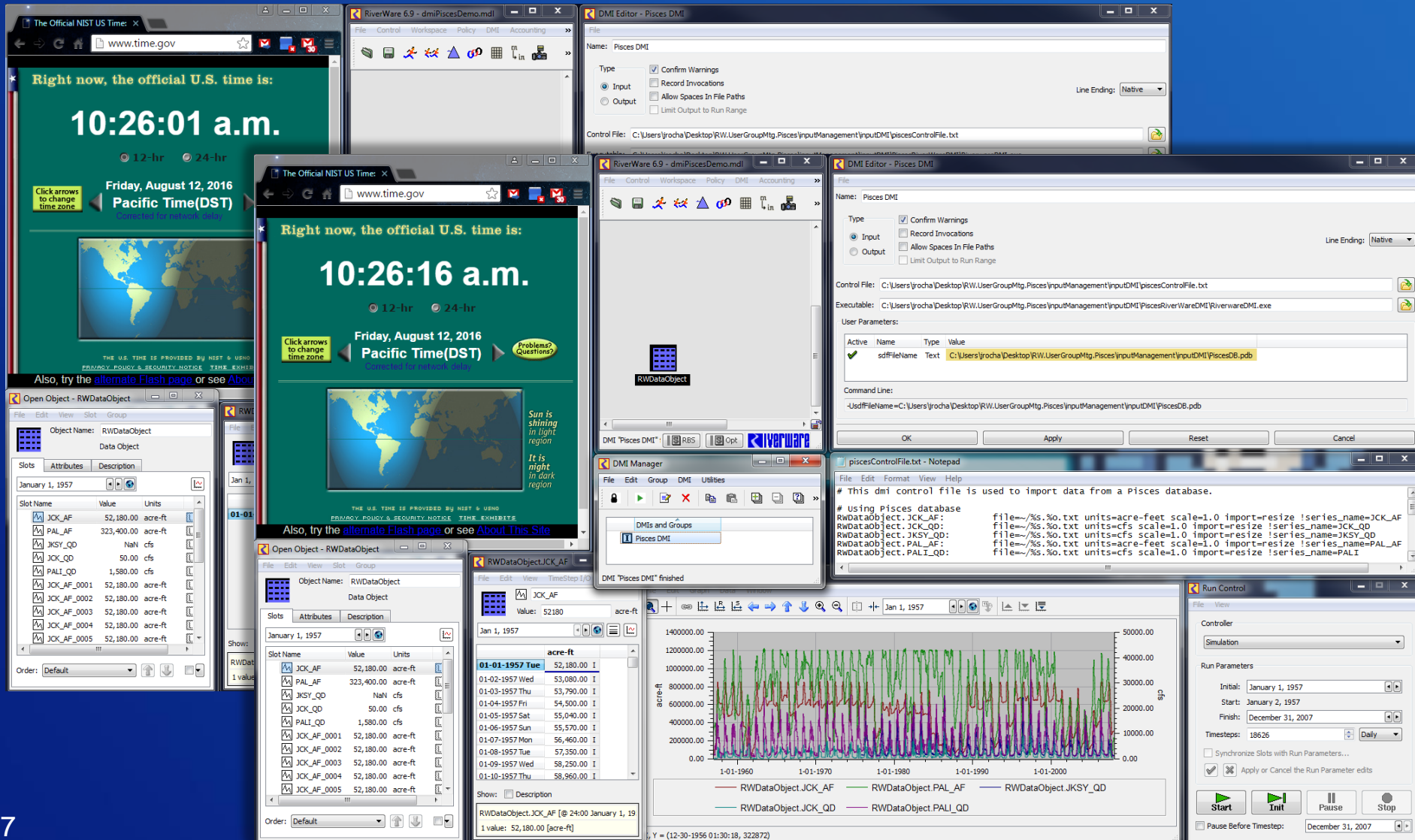
Data Analysis

- Preconfigured hydrologic analyses
 - CY/WY hydrographs
 - Summary hydrographs
 - Exceedance
 - Custom summaries
- All generated via a few mouse-clicks



Input Data Transfer Demo

- Transfer 50 years of daily data for 20 slots in a Data Table object (372K data points)

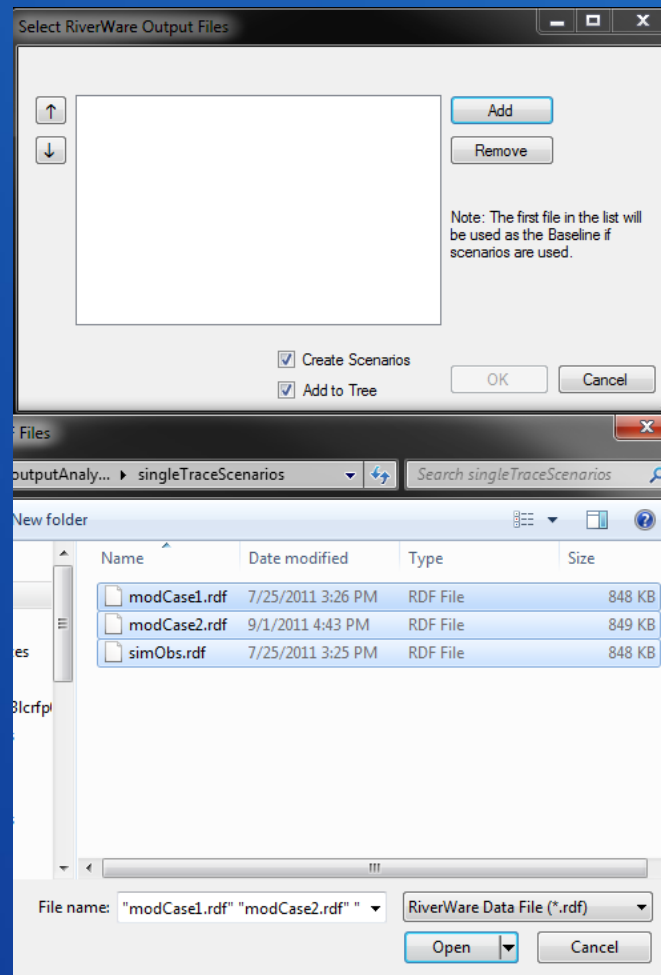
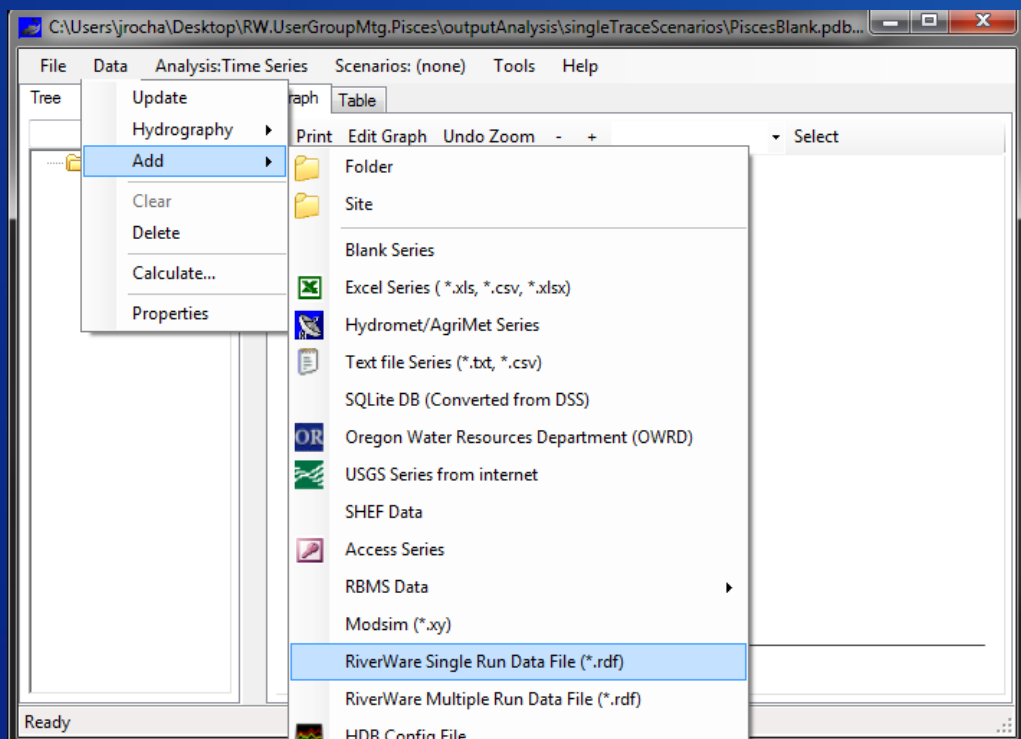


Output Analysis

- Capable of reading and storing RiverWare Data File (*.rdf) outputs
- Single Trace and Multi-Trace analysis options
- Once ingested into Pisces, can use built-in Pisces analysis methods and a few specialized ones

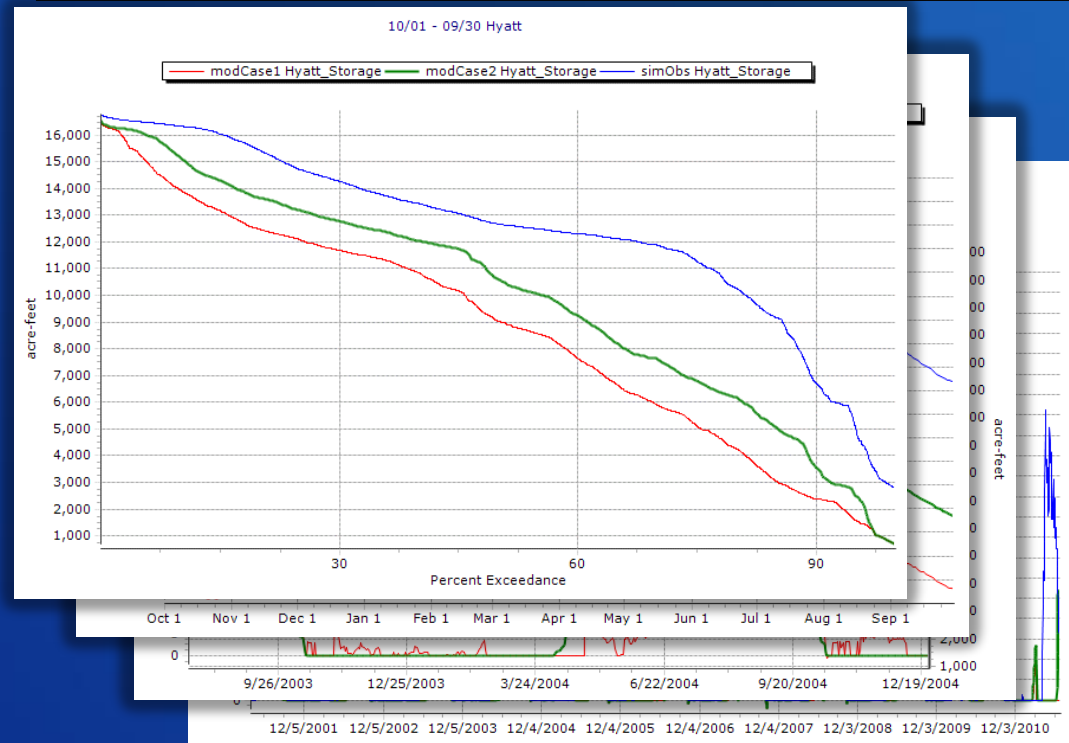
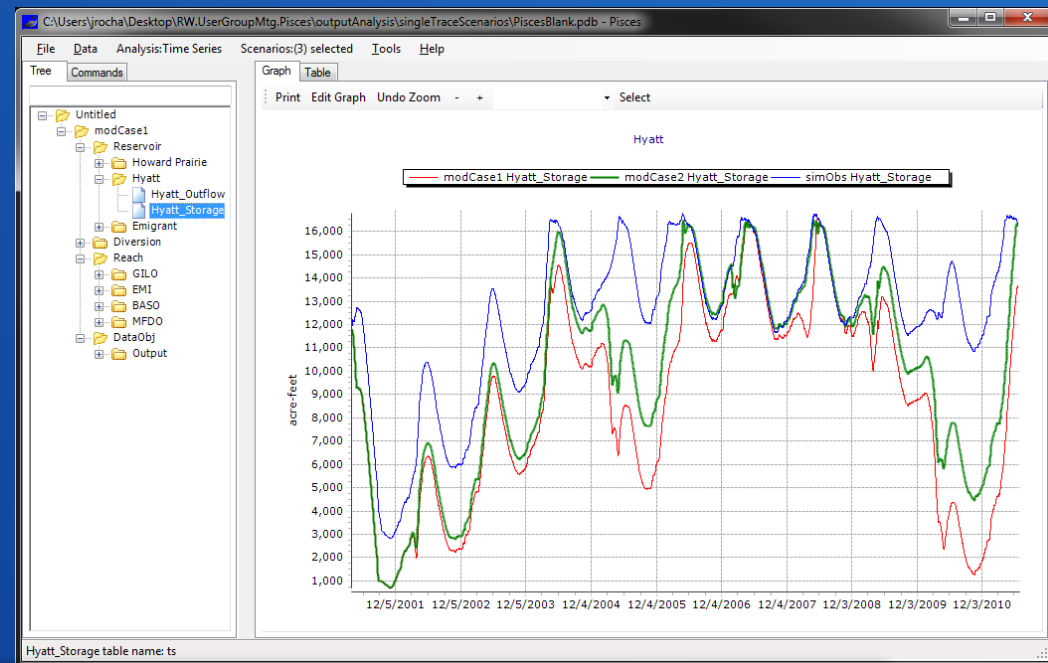
Output Analysis Demo

- Read single run RiverWare outputs



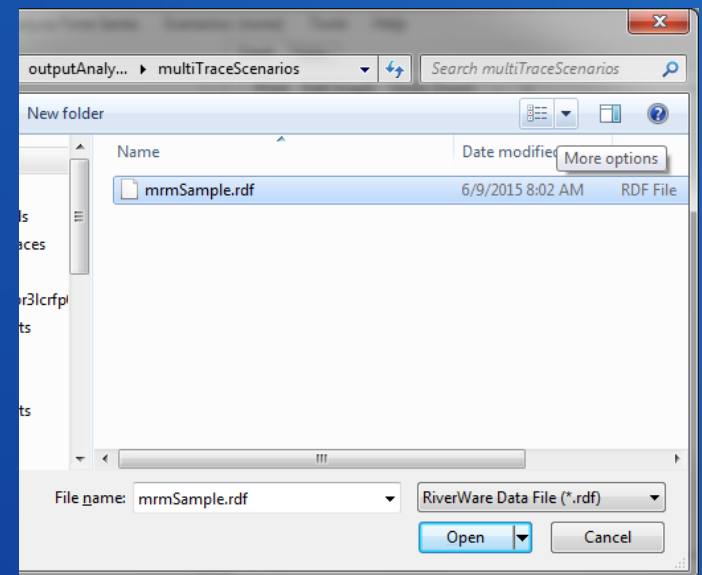
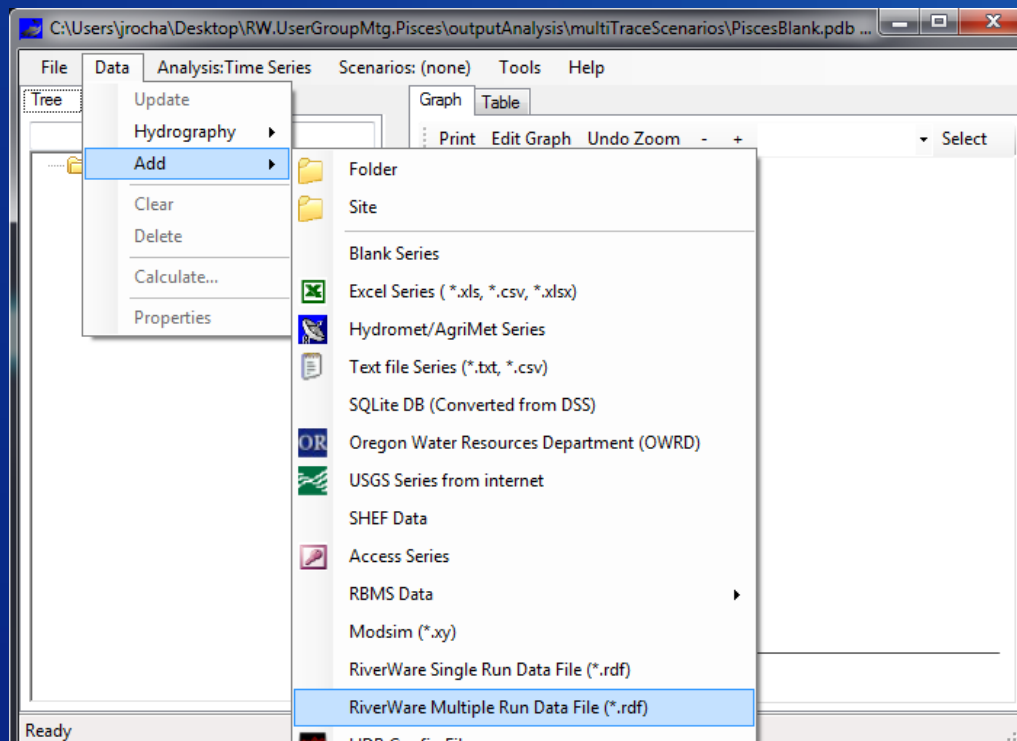
Output Analysis Demo

- Pisces groups outputs into folders
- Compare individual slot outputs between different scenarios
 - Reservoir Storage
 - Reservoir Outflow
 - Etc.
- Plot multiple slots and isolate specific scenarios for a given time range
- Perform analysis on slot outputs
 - Summary Hydrographs
 - Exceedance
 - Etc.



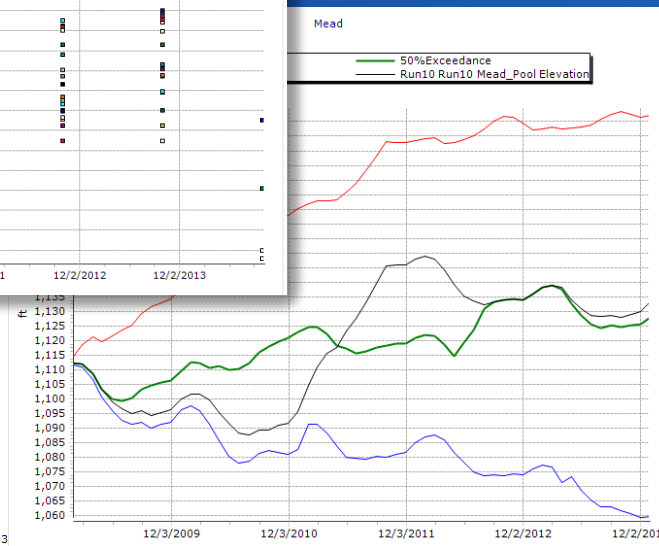
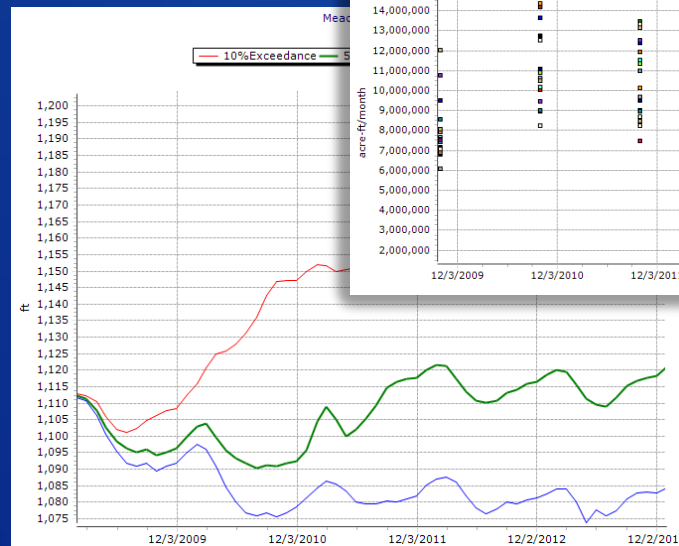
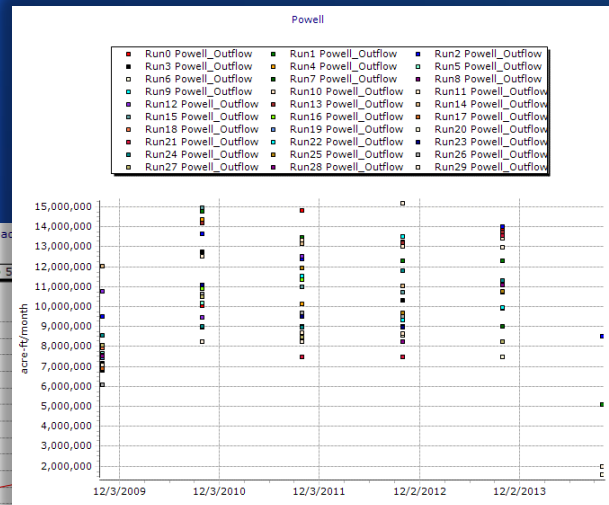
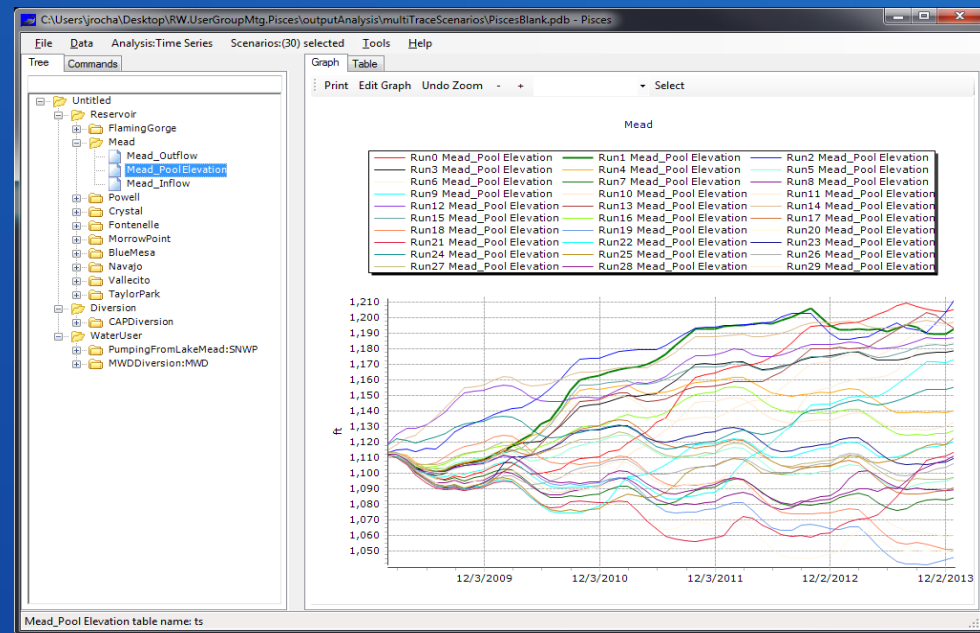
Output Analysis Demo

- Read multiple run RiverWare outputs



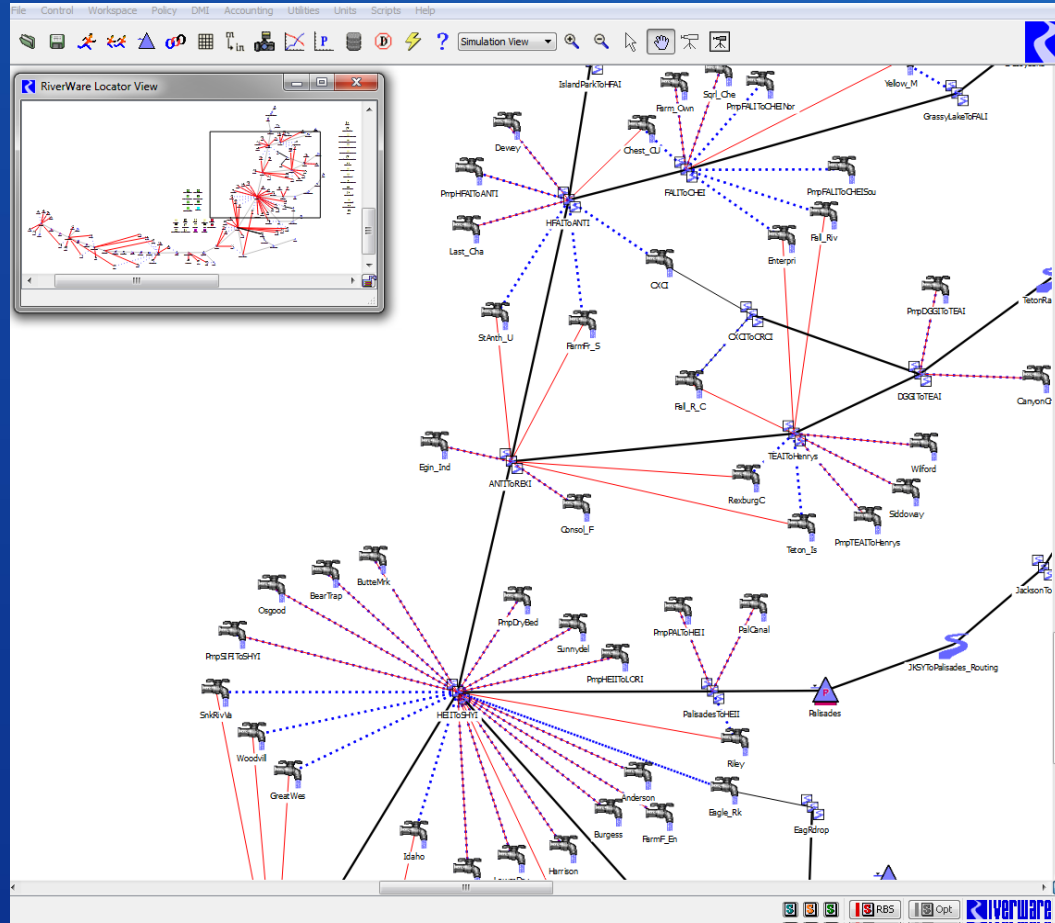
Output Analysis Demo

- Pisces groups outputs into folders
- Compare individual slot outputs between different scenarios
- Plot multiple slots and isolate specific scenarios for a given time range
- Perform analysis on slot outputs
- Perform ensemble analysis
- Isolate/exclude certain years from analysis
- Perform aggregation analysis

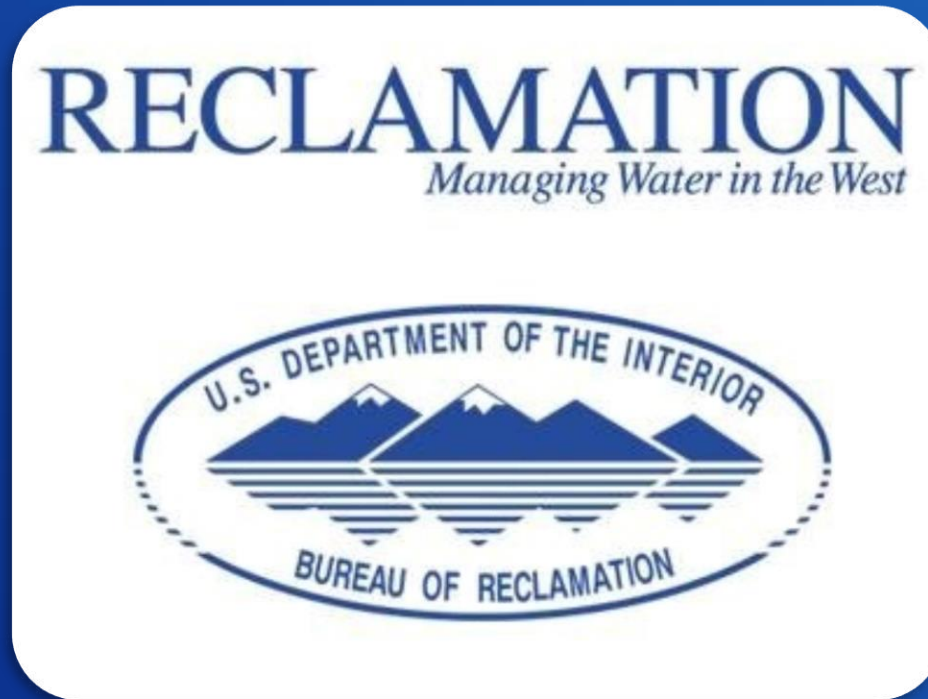


Use Case

- Upper Snake River Operations & Accounting Model
 - Data from USBR, IDWR, USGS
 - Daily time-step
 - 8 reservoirs, 4.2 million acre-ft of storage
 - Over 600 natural flow water rights
 - Over 100 storage contracts
 - Complex structure of accounting logic with physical operations
 - Includes many exchanges, water rentals, fish flow augmentation, etc



Questions



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Pisces DMI Executable & Samples: Available upon request
Pisces Installer: <http://www.usbr.gov/pn/hydromet/pisces/>
Source Code & Wiki: <https://github.com/usbr/Pisces>

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