RECLANATION Managing Water in the West

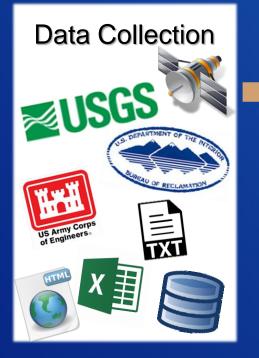
Pisces as an input data management and output analysis tool for RiverWare[®]

RiverWare User Group Meeting August 24, 2016



U.S. Department of the Interior Bureau of Reclamation

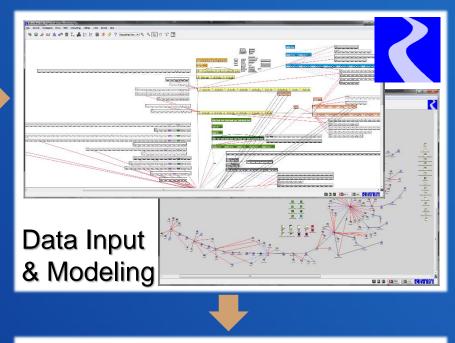
Typical Modeling Process



Data Aggregation & Processing



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

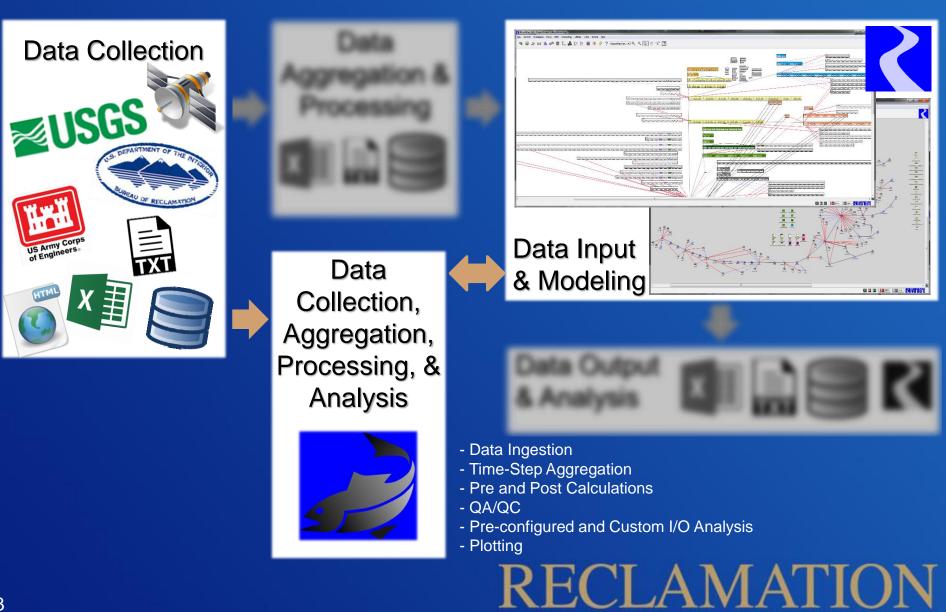


Data Output & Analysis



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

Modeling Process with Pisces



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

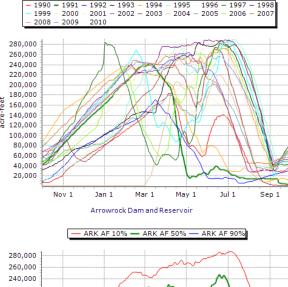
Input Data Management

- 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

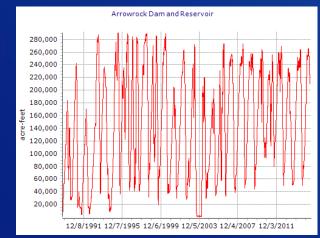
Arrowrock Dam and Reservoir

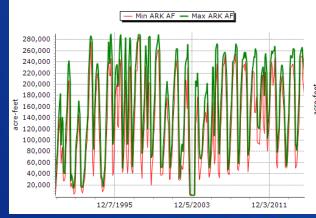


- Preconfigured hydrologic analyses
 - CY/WY hydrographs
 - Summary hydrographs
 - Exceedance
 - Custom summaries
- All generated via a few mouse-clicks



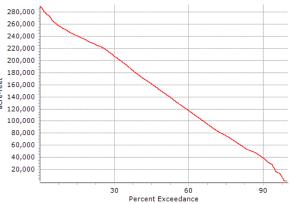






Monthly Summary Arrowrock Dam and Reservoir

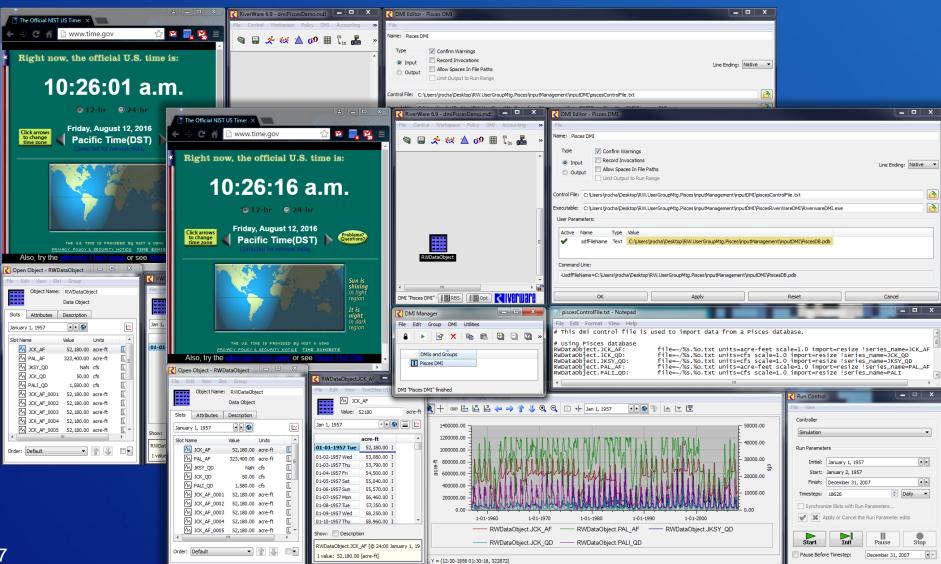
10/01 - 09/30 Arrowrock Dam and Reservoir



6

Input Data Transfer Demo

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



7

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

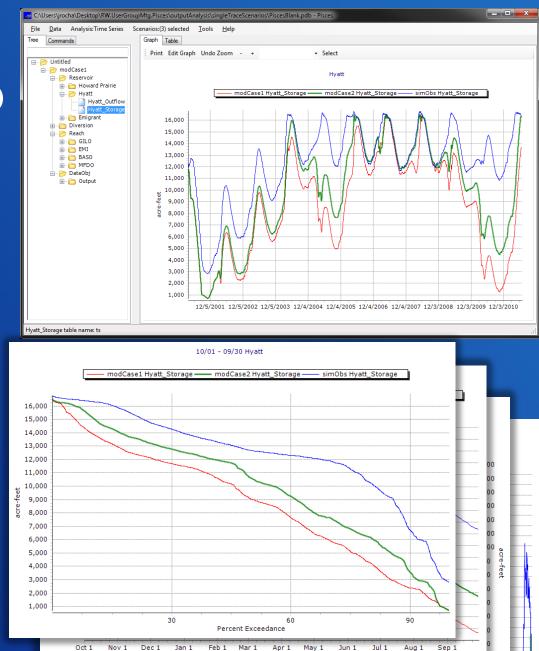
- Read single run RiverWare outputs

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				Text file Series (*.txt, *.csv)	
				SQLite DB (Converted from DSS)	
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			\sim	USGS Series from internet	
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				RBMS Data	
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				RiverWare Single Run Data File (*.rdf)	
				RiverWare Multiple Run Data File (*.rdf)	
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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.



9/26/2003

12/25/2003

3/24/2004

6/22/2004

12/5/2001 12/5/2002 12/5/2003 12/4/2004 12/4/2005 12/4/2006 12/4/2007 12/3/2008 12/3/2009 12/3/2010

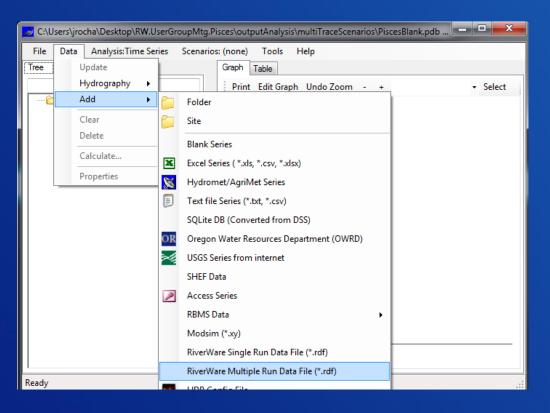
9/20/2004

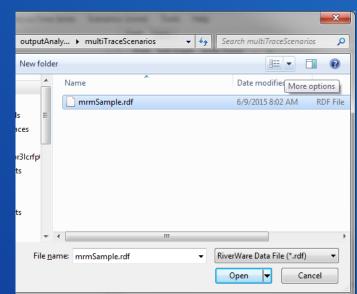
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12/19/2004

Output Analysis Demo

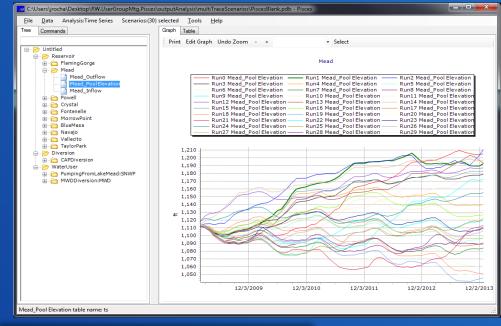
- Read multiple run RiverWare outputs





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



Run2 Powell Outfloy

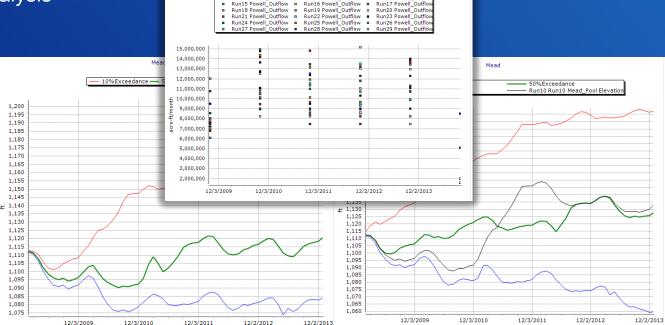
Run5 Powell_Outflov

Run8 Powell Outflow

Run11 Powell Outflo

Run14 Powell Outfle

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Powell

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Run1 Powell Outflow

Run4 Powell_Outflow

Run7 Powell Outflow

Run10 Powell_Outflow =

Run13 Powell_Outflow ■

Run0 Powell Outflow

Run3 Powell_Outflow

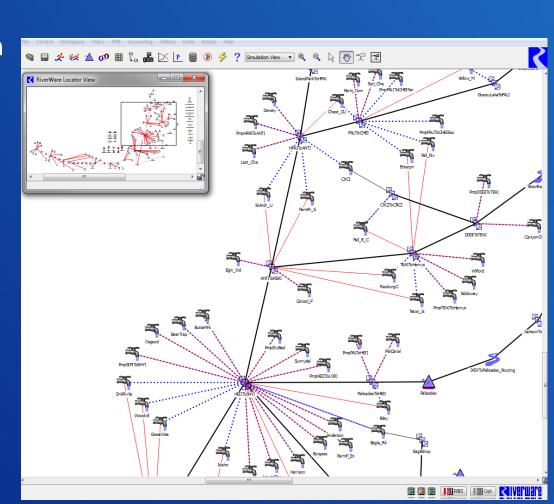
Run6 Powell Outflow

Run9 Powell_Outflow

Run12 Powell_Outflow

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



Developers: Karl Tarbet, ktarbet@usbr.gov Bob Lounsbury, blounsbury@usbr.gov Jon Rocha, jrocha@usbr.gov Pisces DMI Executable & Samples: Available upon request Pisces Installer: http://www.usbr.gov/pn/hydromet/pisces/ Source Code & Wiki: https://github.com/usbr/Pisces

