Operations Control Office

Delta Compliance & Modeling:

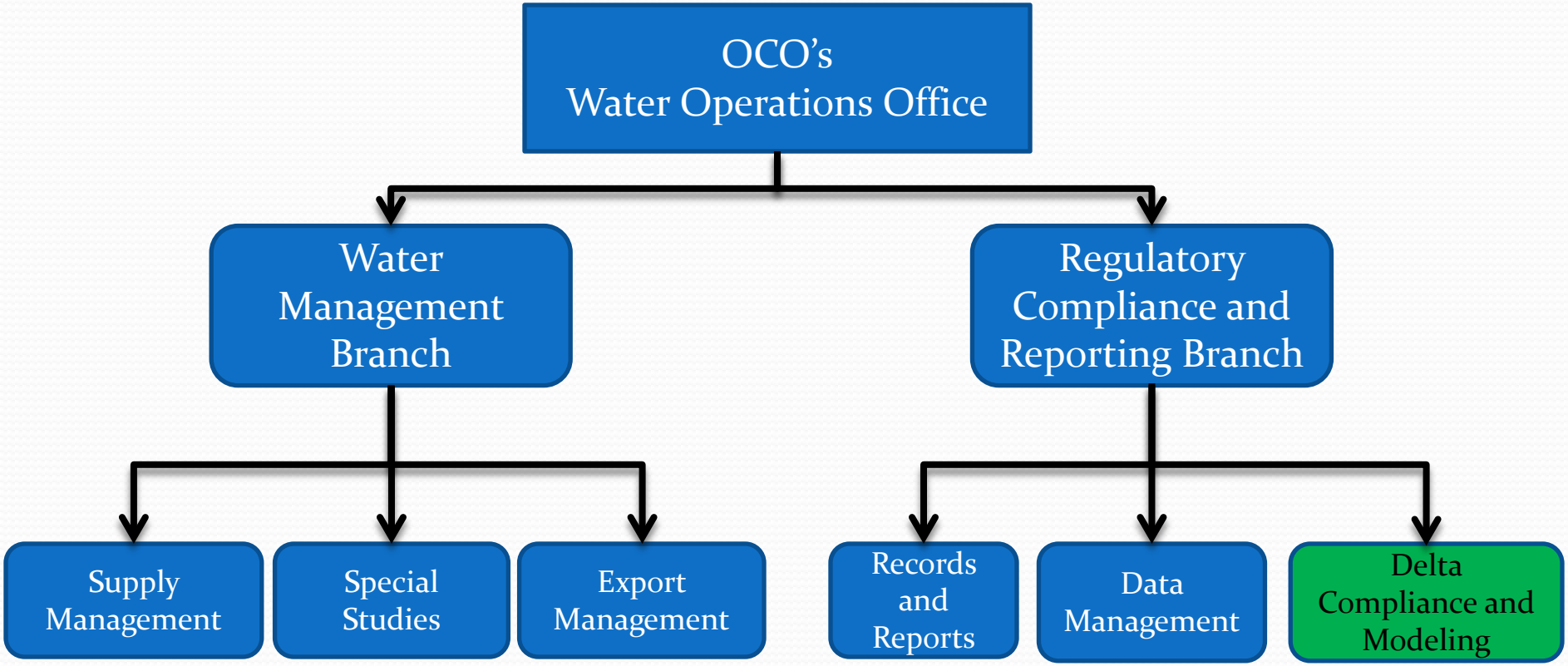
Presented by: James Edwards
Siqing Liu

DSM2 User Group Meeting
November 12, 2015

Overview

- Who we are
- Why we run the model
- Simulations
- Recent Tool Updates

Who we are


OCO's
Water Operations Office
Water Management Branch
Regulatory Compliance and Reporting Branch
Supply Management
Special Studies
Export Management
Records and Reports
Data Management
Delta Compliance and Modeling

Bay-Delta Standards

Contained in D-1641

DRAFT

CRITERIA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
FLOW/OPERATIONAL												
• **Fish and Wildlife**												
SWP/CVP Export Limits					1,500cfs [1]							
Export/Inflow Ratio [2]	65%	35% of Delta Inflow [3]					65% of Delta Inflow					
Minimum Delta Outflow	[4]						3,000 - 8,000 cfs [4]					
Habitat Protection Outflow		7,100 - 29,200 cfs [5]										
Salinity Starting Condition [6]		[6]										
River Flows:												
@ Rio Vista									3,000 - 4,500 cfs [7]			
@ Vernalis - Base		710 - 3,420 cfs [8]				[8]						
- Pulse				[9]						+28TAF		
Delta Cross Channel Gates	[10]	Closed				[11]					Conditional [10]	
WATER QUALITY STANDARDS												
• **Municipal and Industrial**												
All Export Locations	≤ 250 mg/l Cl											
Contra Costa Canal	150 mg/l Cl for the required number of days [12]											
• **Agriculture**												
Western/Interior Delta				Max.14-day average EC mmhos/cm [13]								
Southern Delta [14]		1.0 mS		30 day running avg EC 0.7 mS					1.0 mS			
• **Fish and Wildlife**												
San Joaquin River Salinity [15]				14-day avg; 0.44 EC								
Suisun Marsh Salinity [16]	12.5 EC	8.0 EC		11.0 EC						19.0 EC	[17]	15.5 EC

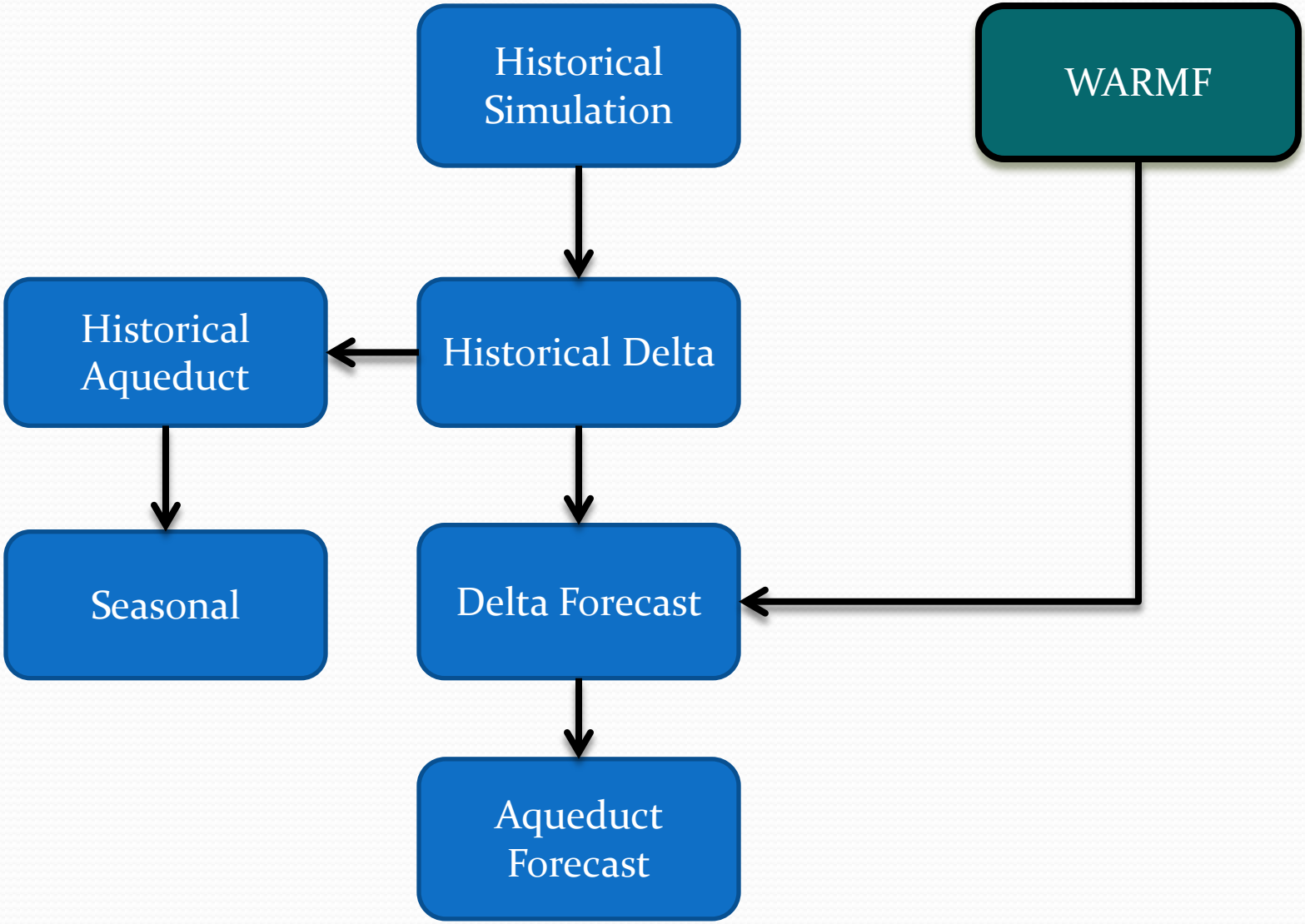
NMFS & FWS Biological Opinions

Reasonable and Prudent Alternatives

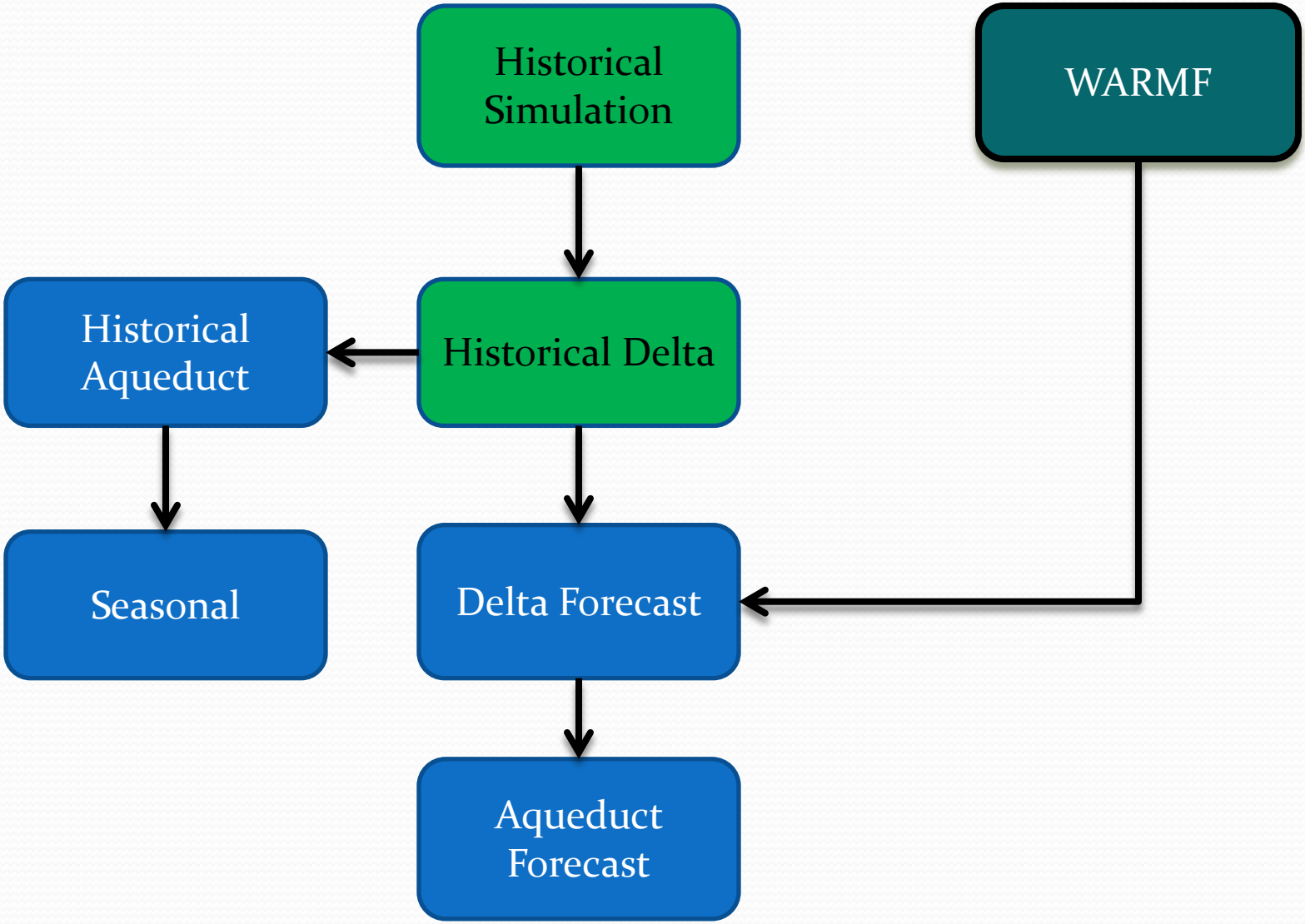
DRAFT

CRITERIA	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
National Marine Fisheries Service												
Action IV. 1.2 DCC Gate Operation	Oct 1 - Nov 30 Gates Are Closed if Fish Are Present		Dec 1 - 14	Dec 15 - Jan 31 Gates Are Closed	Feb 1 - May 15 Gates Are Closed per D1641			May 16 - Jun 16 up to 14 Days Closed per D1641				
Action IV. 2.1 San Joaquin River Inflow/Export Ratio			Gates Are Closed except for Experiments/WQ				Apr 1 - May 31 Maintain Vernalis I/E Ratio		Interim - Based on IOP Water Supply Long Term - Based on WY Type			
Action IV. 2.2 Six-Year Acoustic Tag Experiment						Mar 1 - Jun 15						
Action IV. 2.3 Old & Middle River Flow Management				Jan 1 - Jun 15 OMR (-5000 to -2500 cfs) until after Jun 1 Water Temperature @ Mossdale ≥ 72°F for 7 Days								
Action IV. 3 Reduce Likelihood of Entrainment or Salvage		Nov 1 - Dec 31										
Fish & Wildlife Service												
Action 1 Adult Migration & Entrainment (1st Flush)			Dec 1 - 20	After Dec 20 Triggers: Turbidity or Salvage Off Ramps: Water Temperature or Biological								
Action 2 Adult Migration & Entrainment			Begins Imediately After Action 1. Suspension of Action: Flow Off Ramps: Water Temperature or Biological									
Action 3 Entrainment Protection of Larval Smelt					Triggers: Water Temperature or Biological Off Ramps: Water Temperature or June 30							
Action 4 Estuarine Habitat During Fall (X2)	Oct 1 - Nov 30											Sep 1 - 30
Action 5 Temporary Spring HORB & the TBP							Apr 1 - May 15					

Simulations



Simulations



DSM2 Historical Data

- Calibration/verification
- Fill in historical data gaps

Historical Data

Inflows, Exports, Concentrations

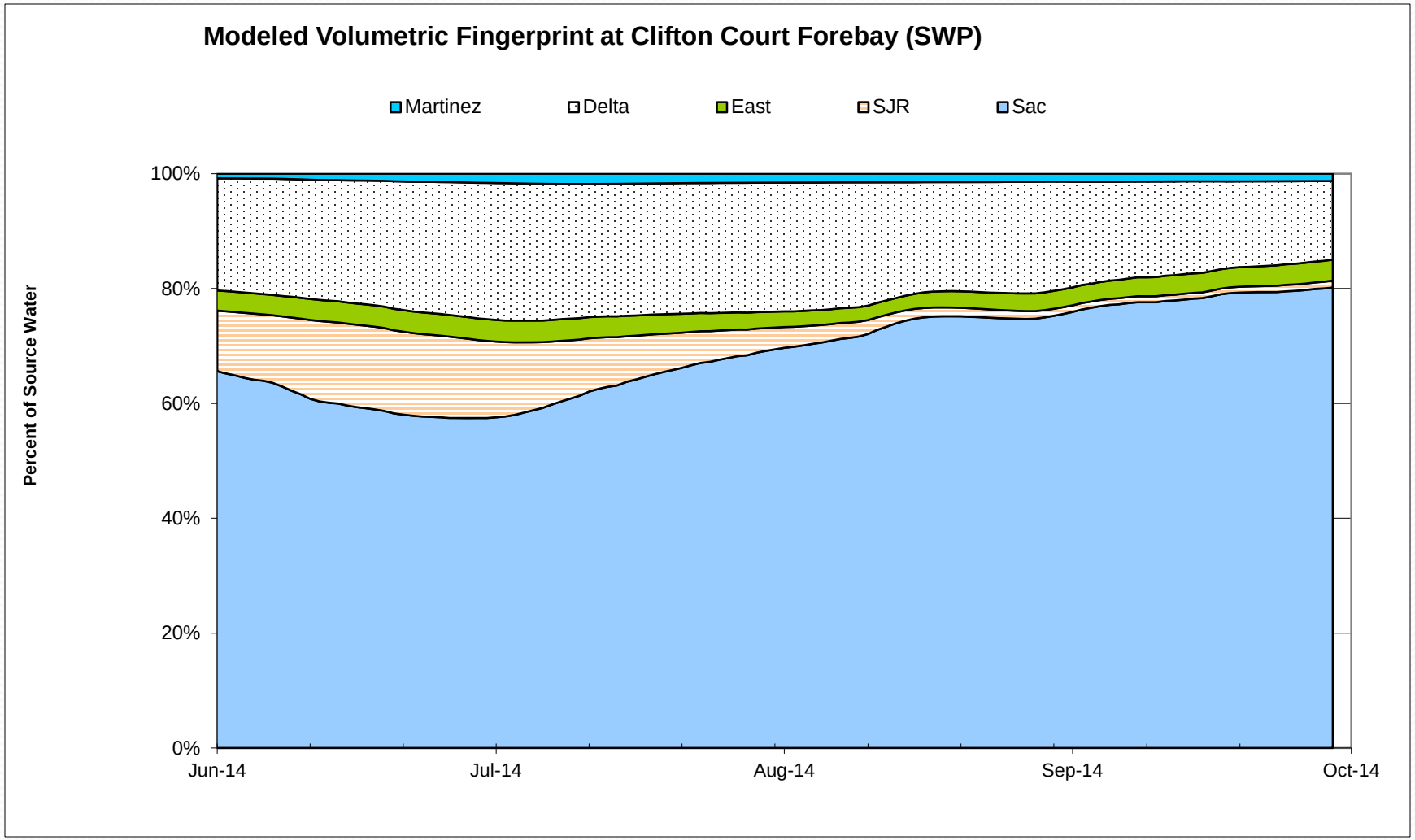
Tide: Historic or Astronomical

→

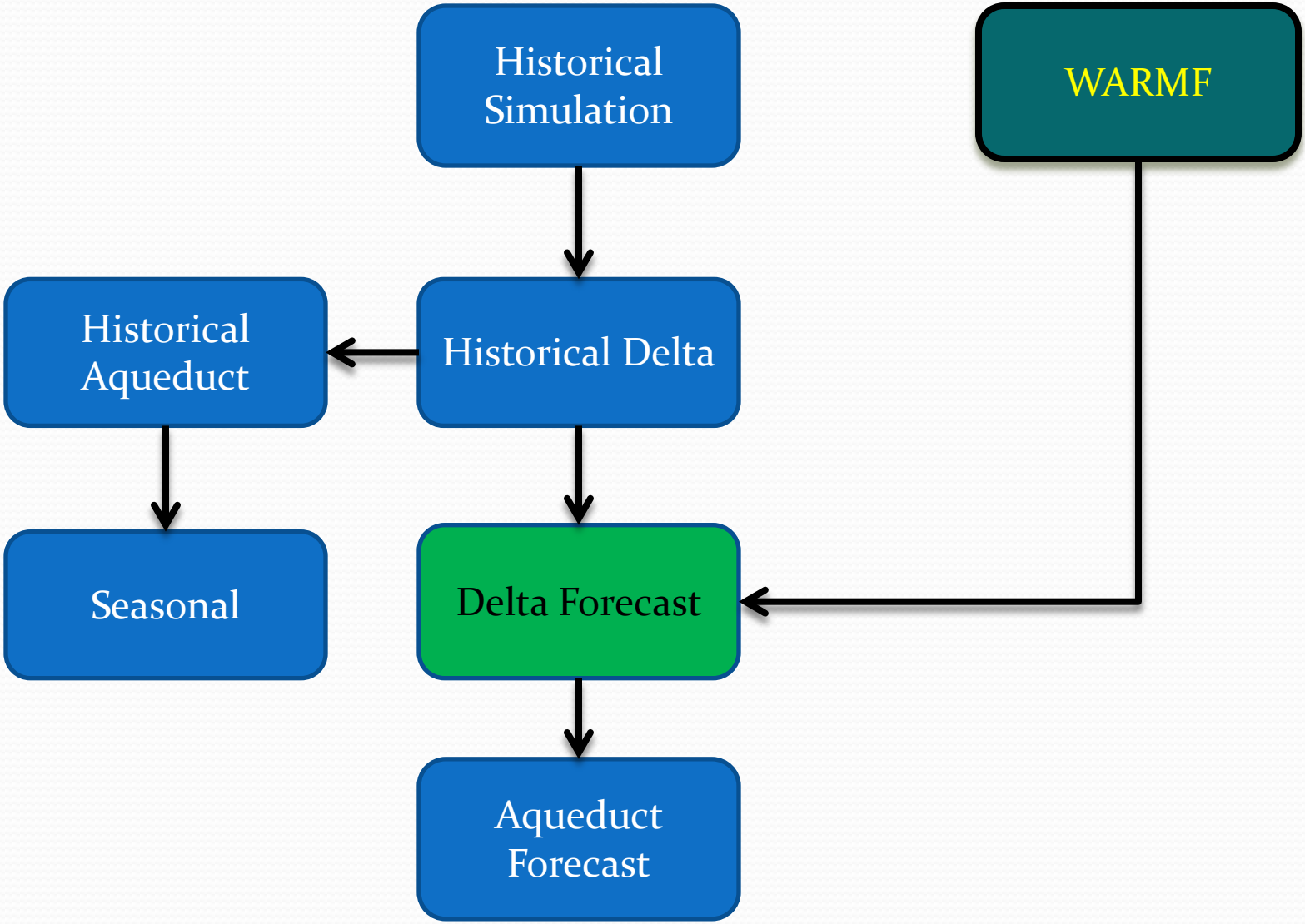
Output

Historical flows, water stages, and concentrations

Historical Output



Simulations



DSM2 Forecast

Recent Data

Inflows, Exports, Concentrations

Tide: Historic and Astronomical Projection

→

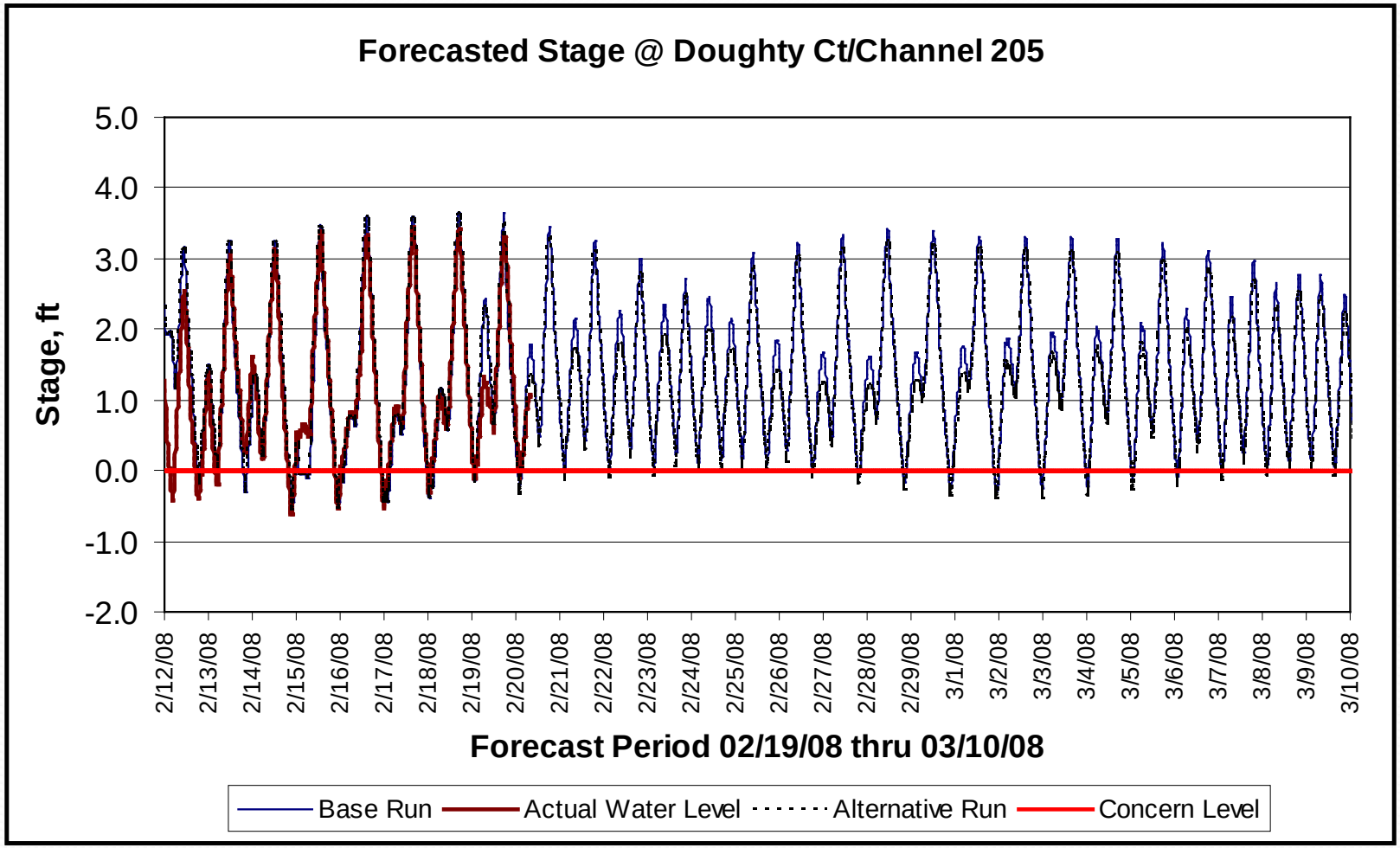
DSM2

→

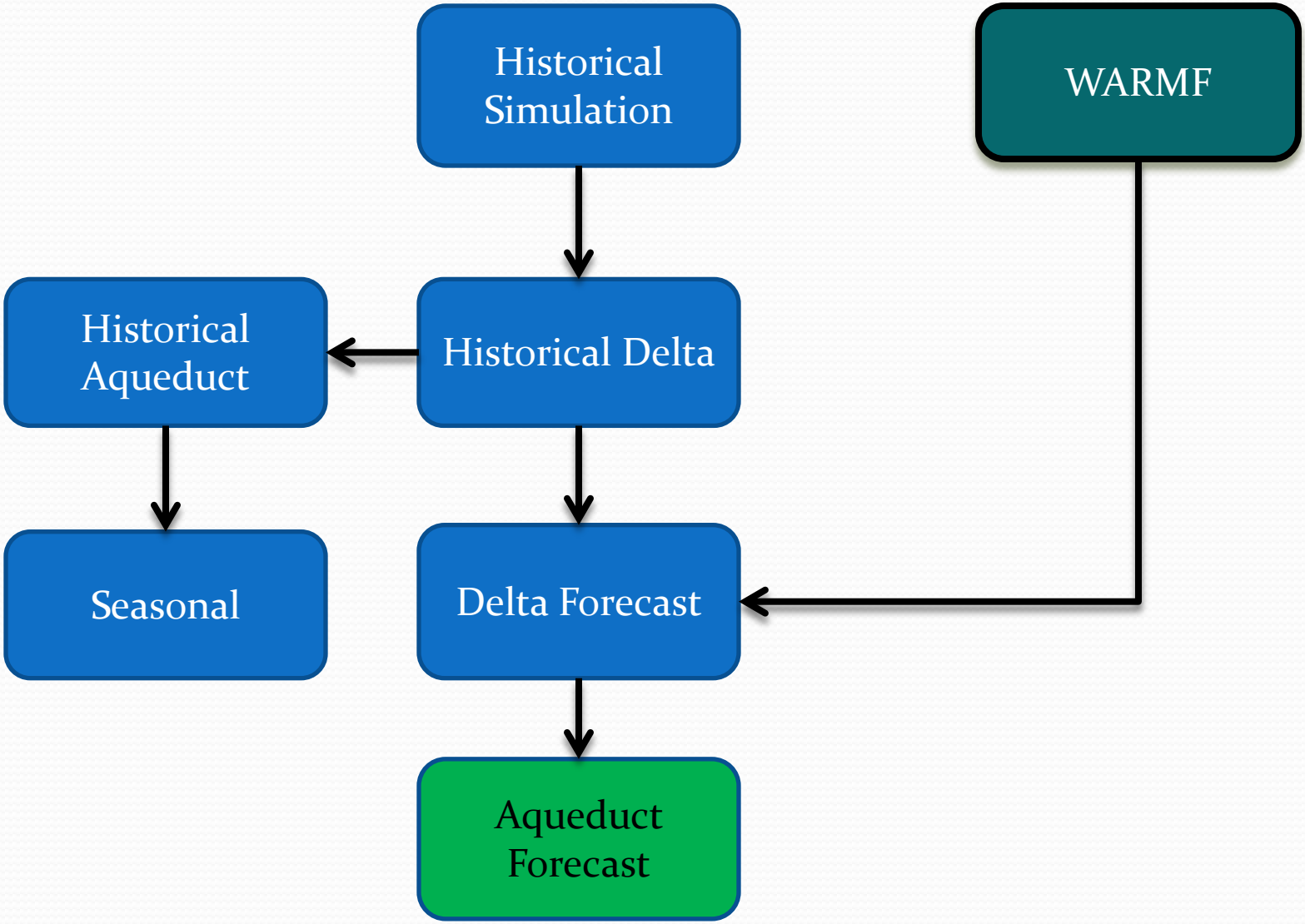
Output

Forecast flows, water stages, and concentrations

Forecast Output



Simulations



Aqueduct Forecast

Recent Data

Concentration boundary conditions

Facility data

→

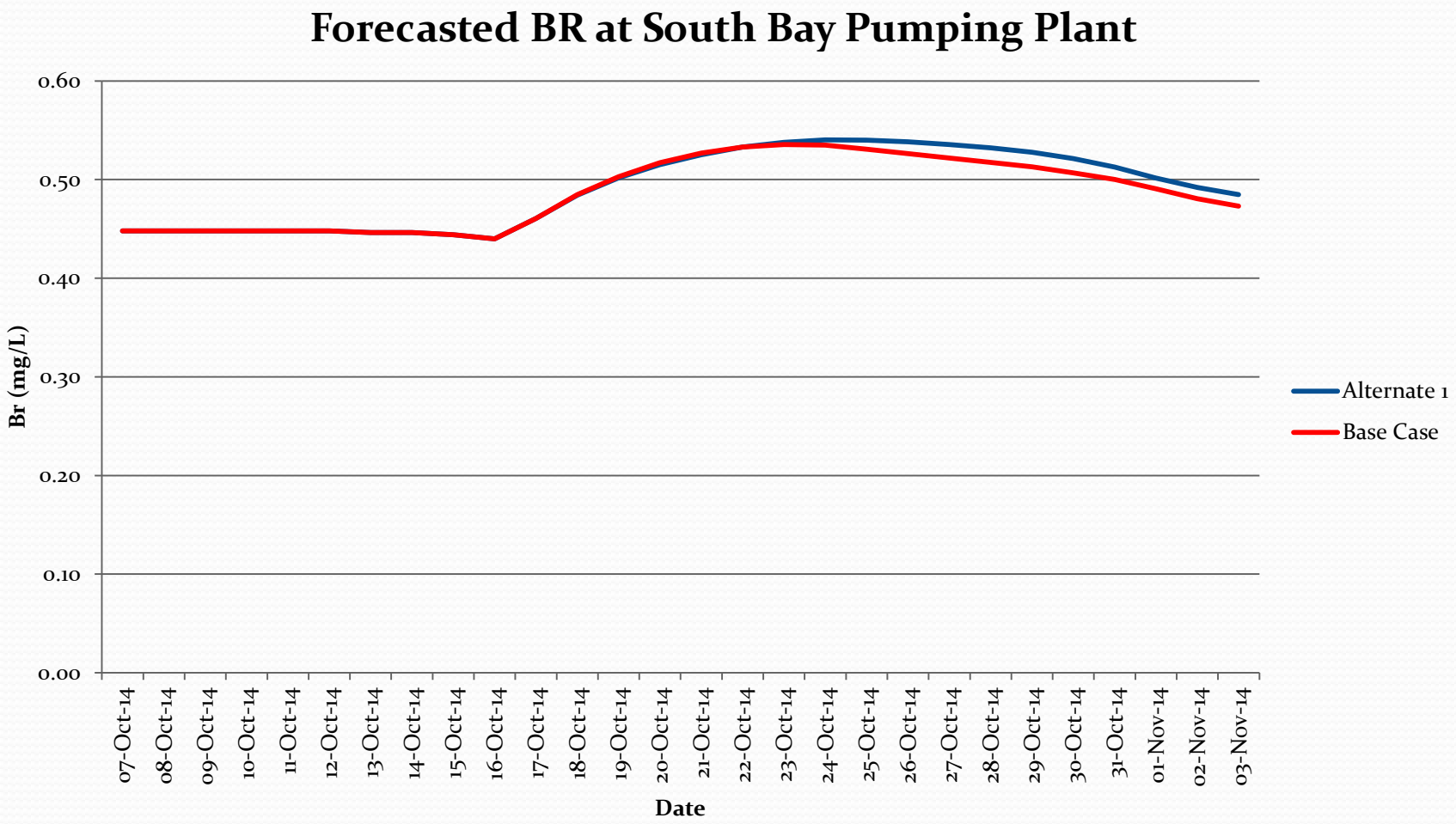
DSM2

→

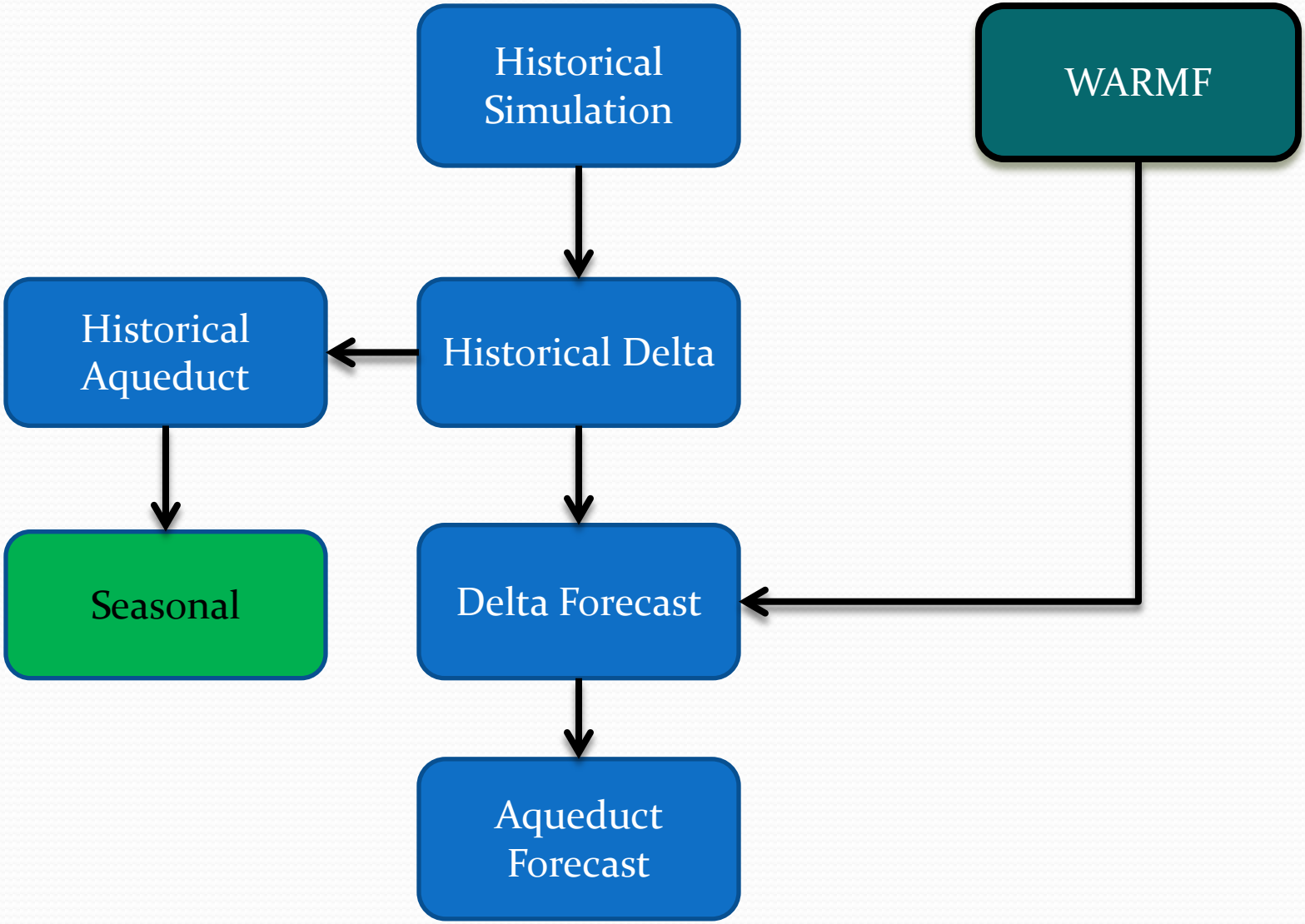
Output

Forecasted Concentrations

Aqueduct Output



Simulations



Seasonal Forecast

Forecasted Data

Delta Coordinated Operations (DCO) study

Historical concentrations

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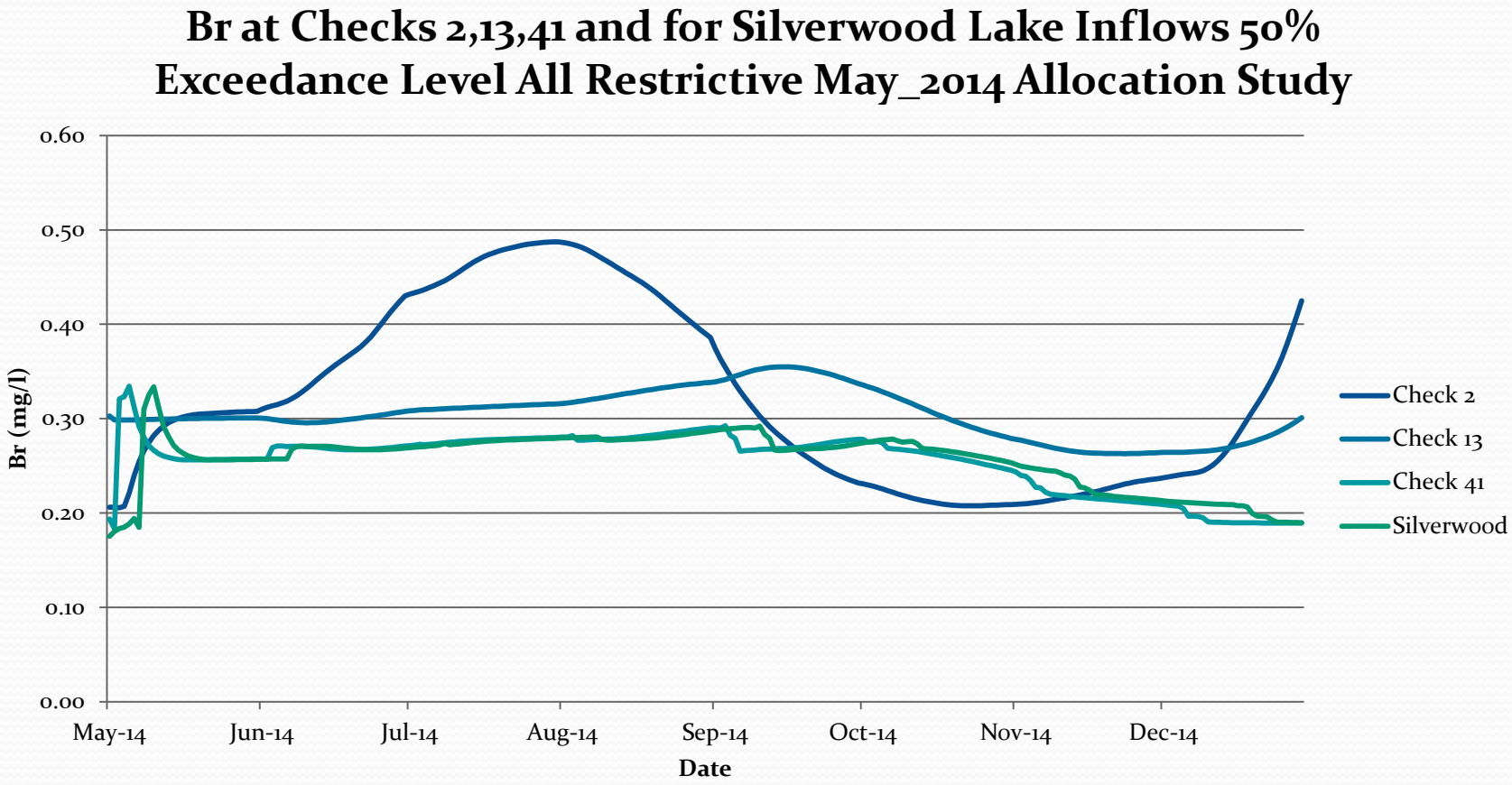
DSM2

→

Output

Forecasted concentrations

Seasonal Forecast

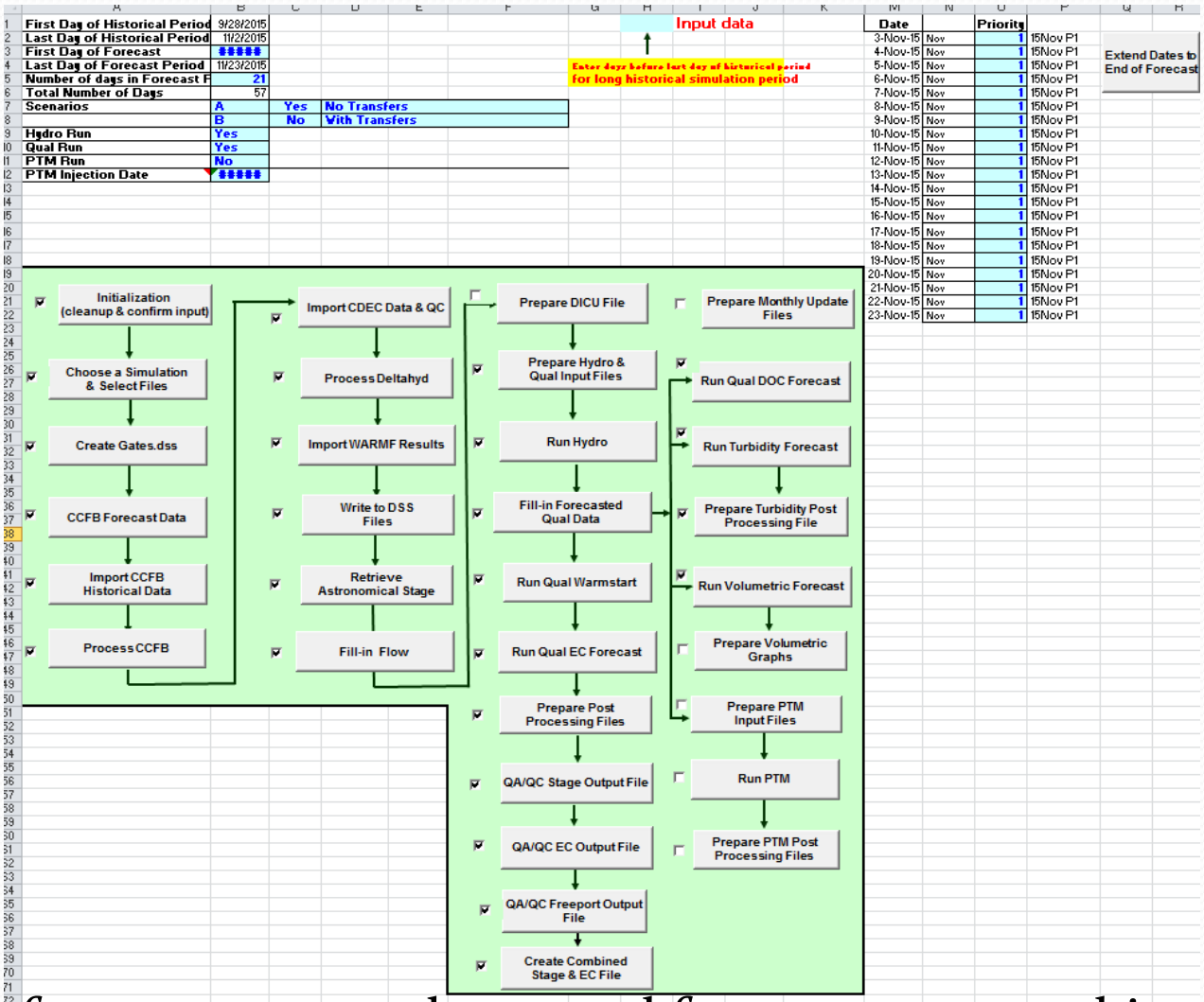


Summary

- Historical simulations
  - Calibration, fill in data gaps, initial conditions
- Forecast simulations
  - Analyze trends, compare different operational scenarios
- Hindcast simulations
  - Determine water supply impacts or conserved water
- Seasonal forecast
  - Analyze long-term trends

Recent Updates

Combined Tools



- Tools for near-term and seasonal forecast were combined
- Tool was modified to allow for historical simulation
- More salinity data used in DSM2 QUAL Initialization

DSM2-QUAL Initialization

- Initial condition optimization, a program developed by Eli in 2000
- Based on the principle of superposition

$$\min_{\alpha_i} \sum_{x,t} w_x \left[C(x,t) - \hat{C}(x,t) \right]^2$$

such that

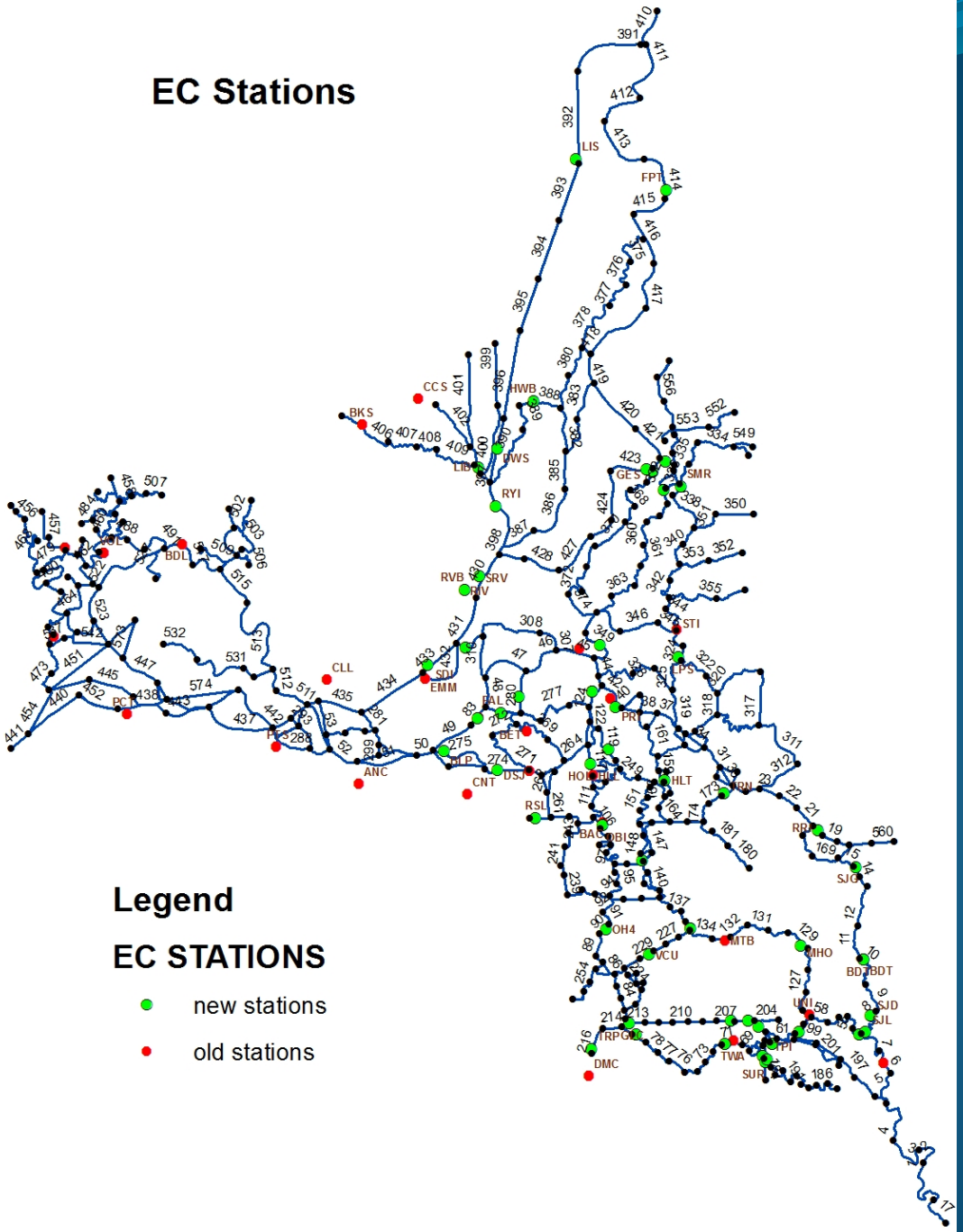
$$\hat{C}(x,t) = \hat{C}_b(x,t) + \sum_{i=1}^{n} \alpha_i \hat{C}_i(x,t)$$

$$\alpha_i > 0 \quad i = 1..n$$

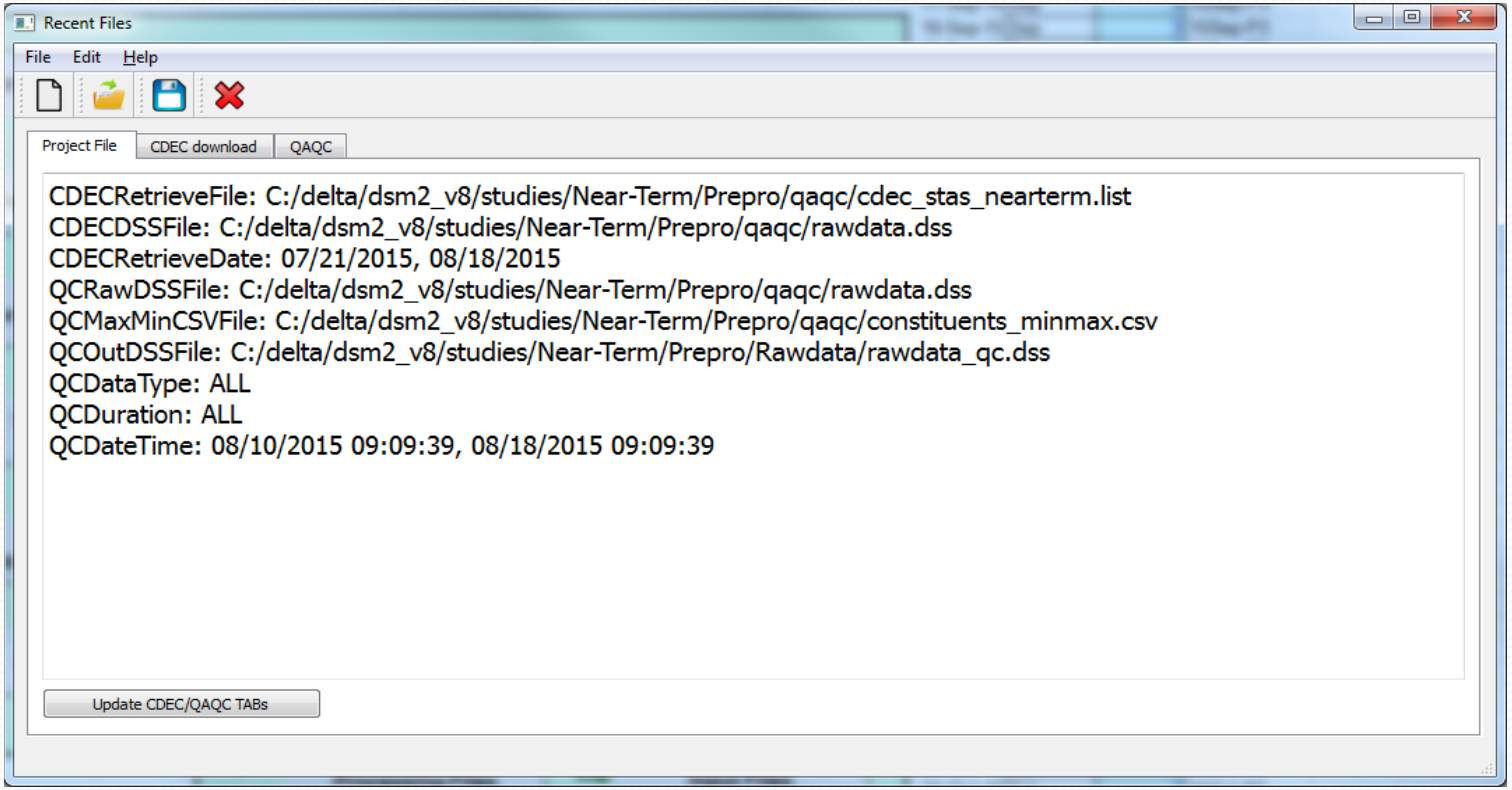
- $C(x,t)$ and $\hat{C}(x,t)$ - observed and modeled EC at station x and time step t
- $\hat{C}_b(x,t)$ – EC obtained from sub-problem with bnd conditions and zero initial conditions
- $\hat{C}_i(x,t)$ - EC obtained from sub-problem with zero bnd conditions and a nominal initial EC of unity in patch I
- W_i – weight depending on station scaling
- α_i – initial condition in the *i*th patch, i.e. the coefficient of the *i*th basic sub-problem

Changes for QUAL Initialization

	Old	New
Monitoring Stations	26	77
Channel Groups	80	114

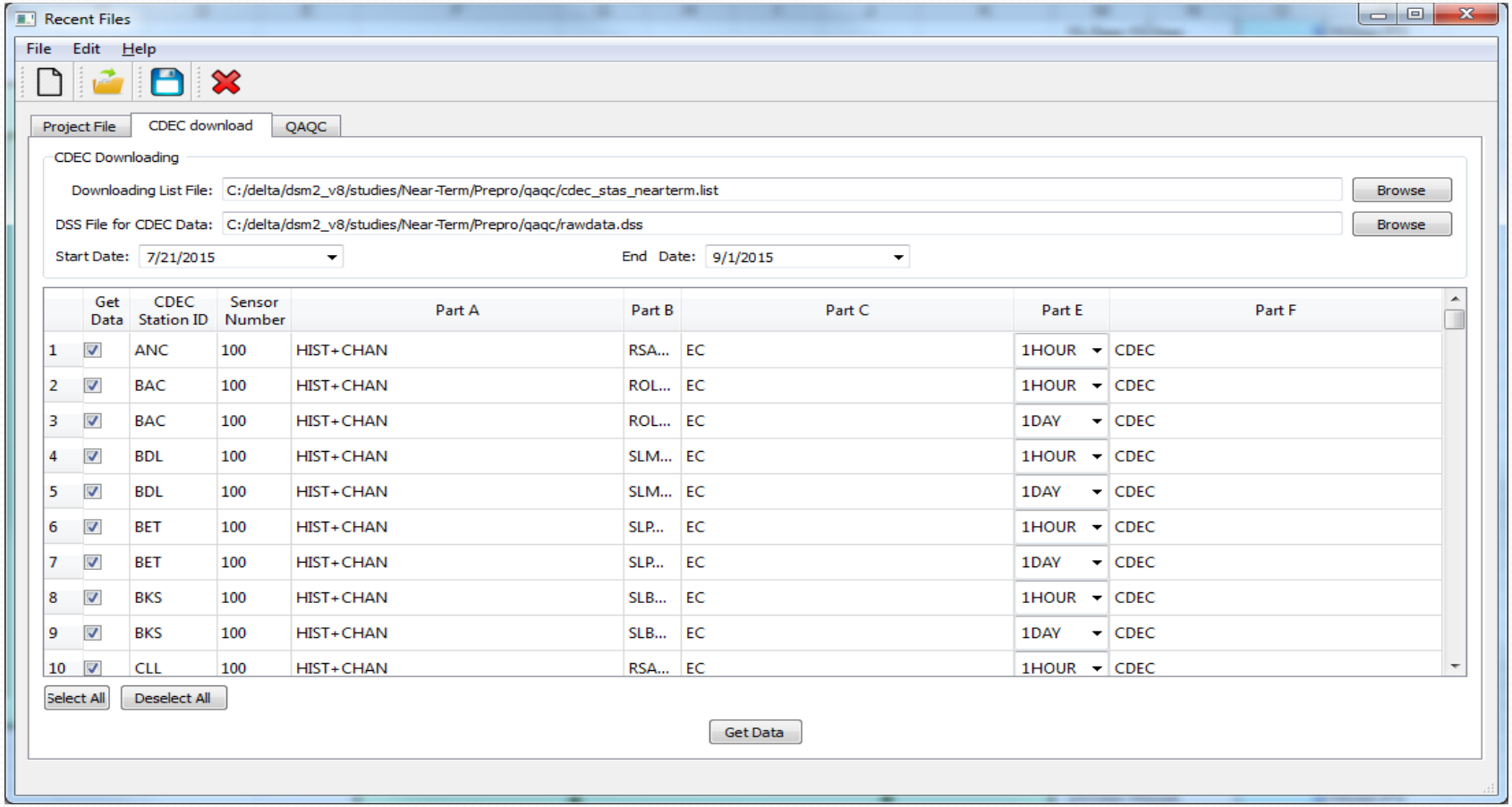


Interface for Data Processing



- Written in Python
- Pyqt for GUI
- Vtools for storing and retrieving data from DSS files
- Matplotlib for plotting

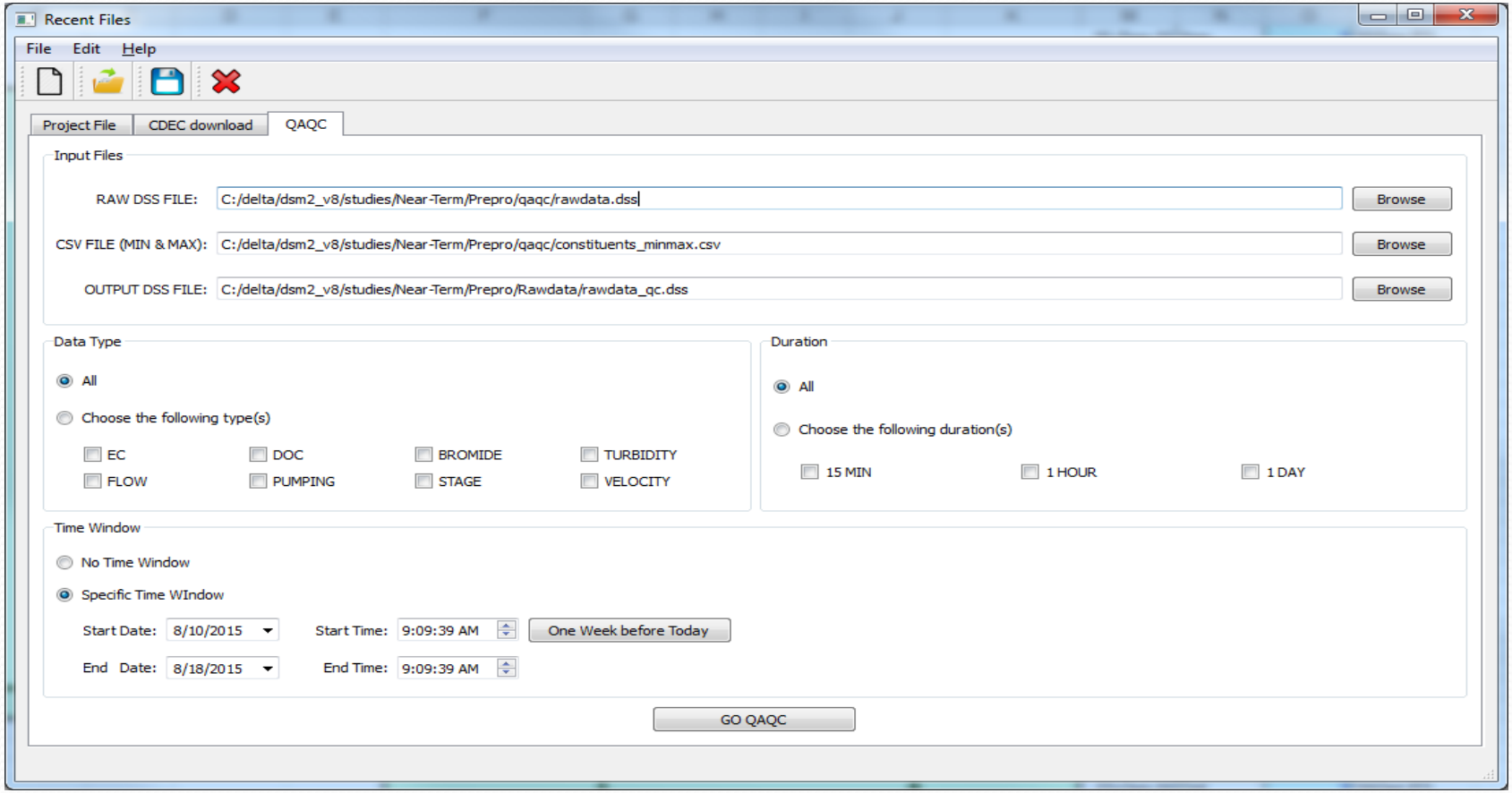
Interface for Downloading Data from CDEC



	Get Data	CDEC Station ID	Sensor Number	Part A	Part B	Part C	Part E	Part F
1	☑	ANC	100	HIST+CHAN	RSA...	EC	1HOUR	CDEC
2	☑	BAC	100	HIST+CHAN	ROL...	EC	1HOUR	CDEC
3	☑	BAC	100	HIST+CHAN	ROL...	EC	1DAY	CDEC
4	☑	BDL	100	HIST+CHAN	SLM...	EC	1HOUR	CDEC
5	☑	BDL	100	HIST+CHAN	SLM...	EC	1DAY	CDEC
6	☑	BET	100	HIST+CHAN	SLP...	EC	1HOUR	CDEC
7	☑	BET	100	HIST+CHAN	SLP...	EC	1DAY	CDEC
8	☑	BKS	100	HIST+CHAN	SLB...	EC	1HOUR	CDEC
9	☑	BKS	100	HIST+CHAN	SLB...	EC	1DAY	CDEC
10	☑	CLL	100	HIST+CHAN	RSA...	EC	1HOUR	CDEC

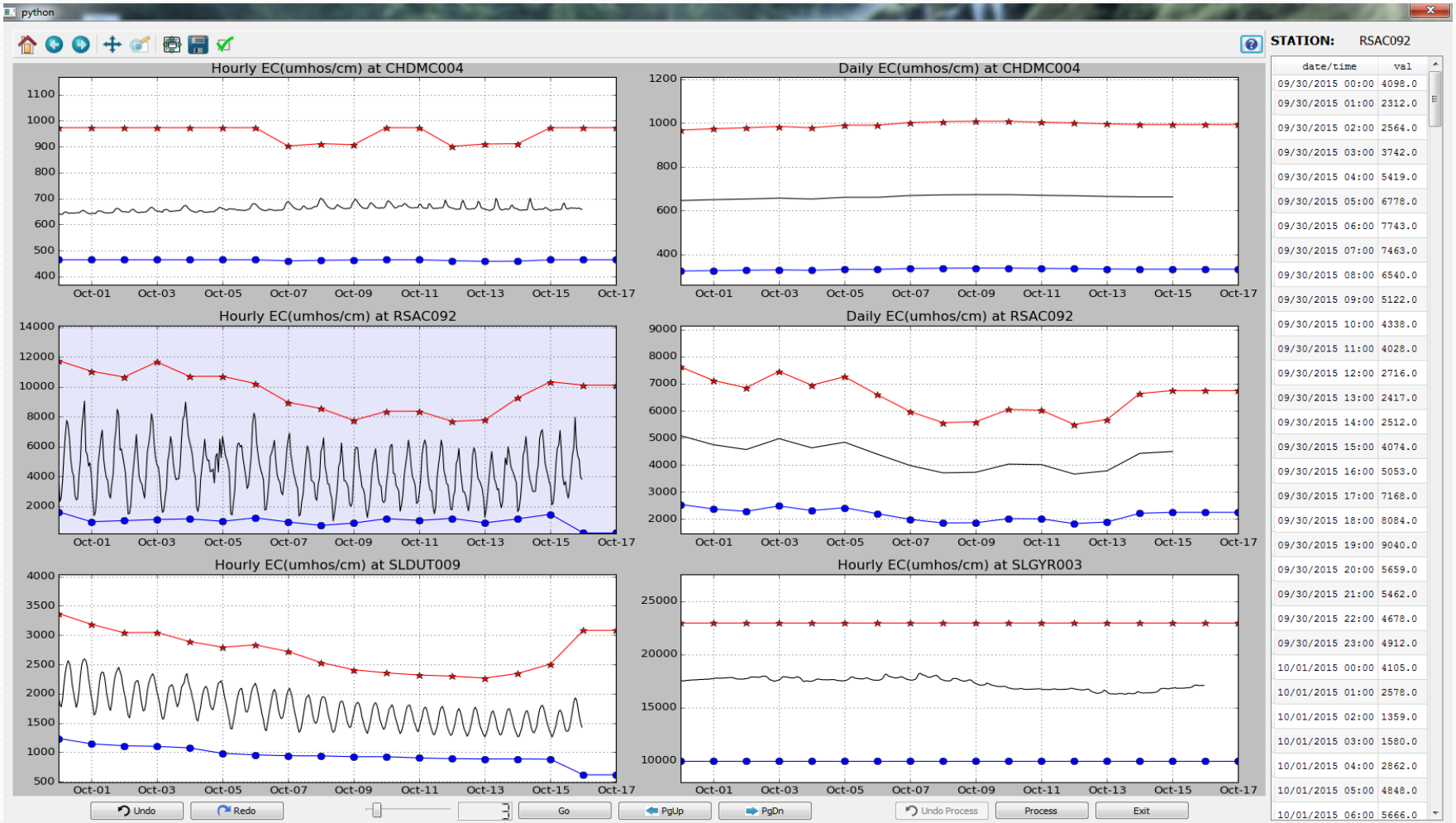
- Download observed for both pre- and –post processing
- Can use .CDEC file for HEC-DSSVue

Interface for Data QAQC Configuration



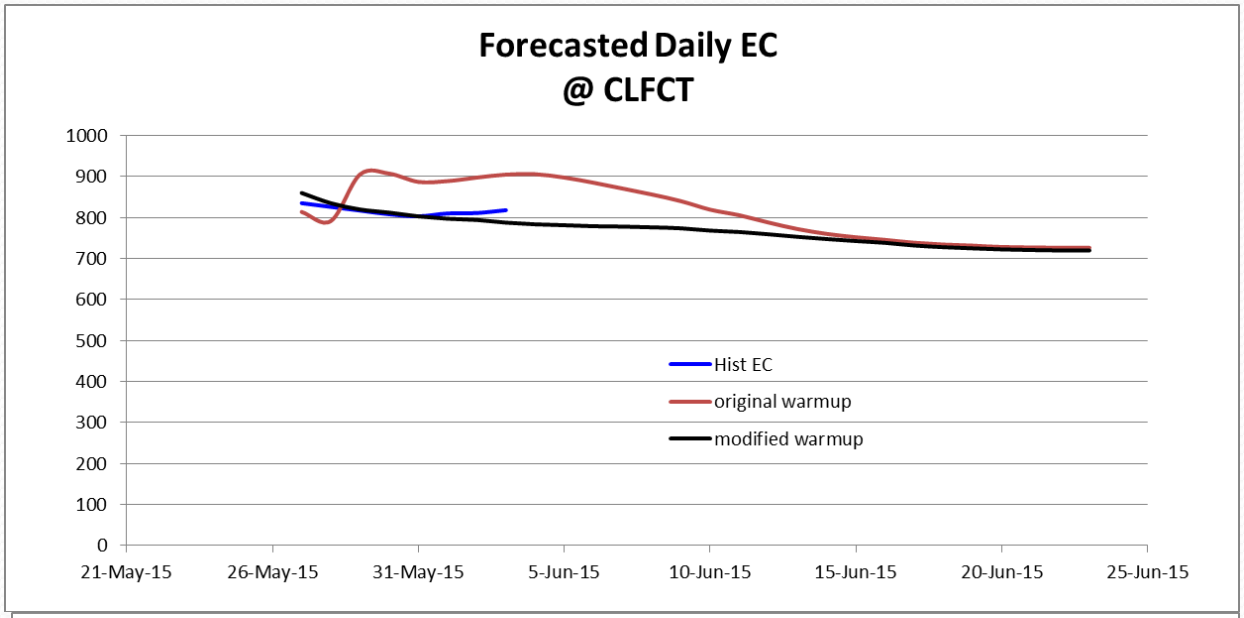
- Process all downloaded data
- Processed data stored in a separate DSS file

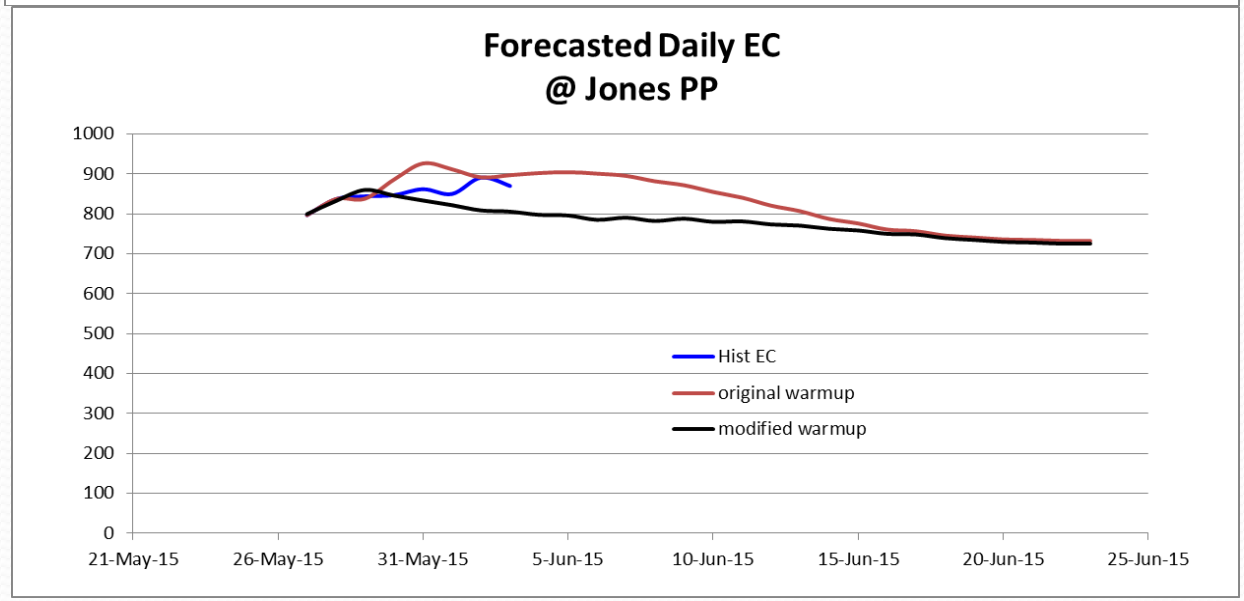
Interface for Data QA/QC



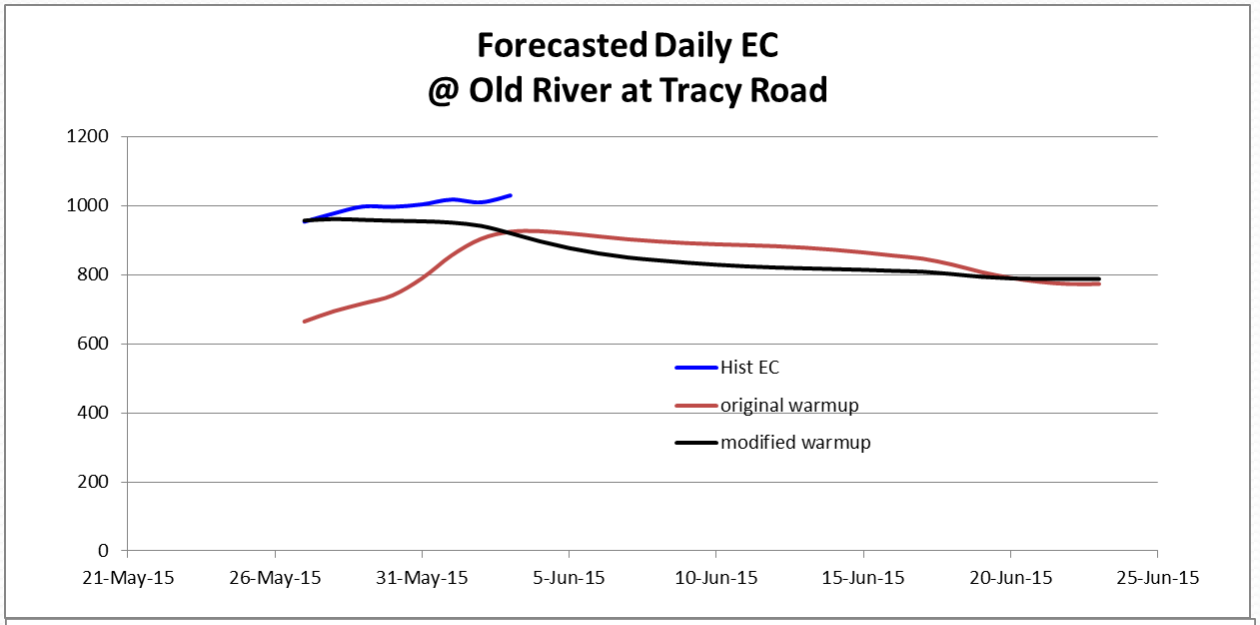
- Process 6 time-series each time
- Modify data from table or plot

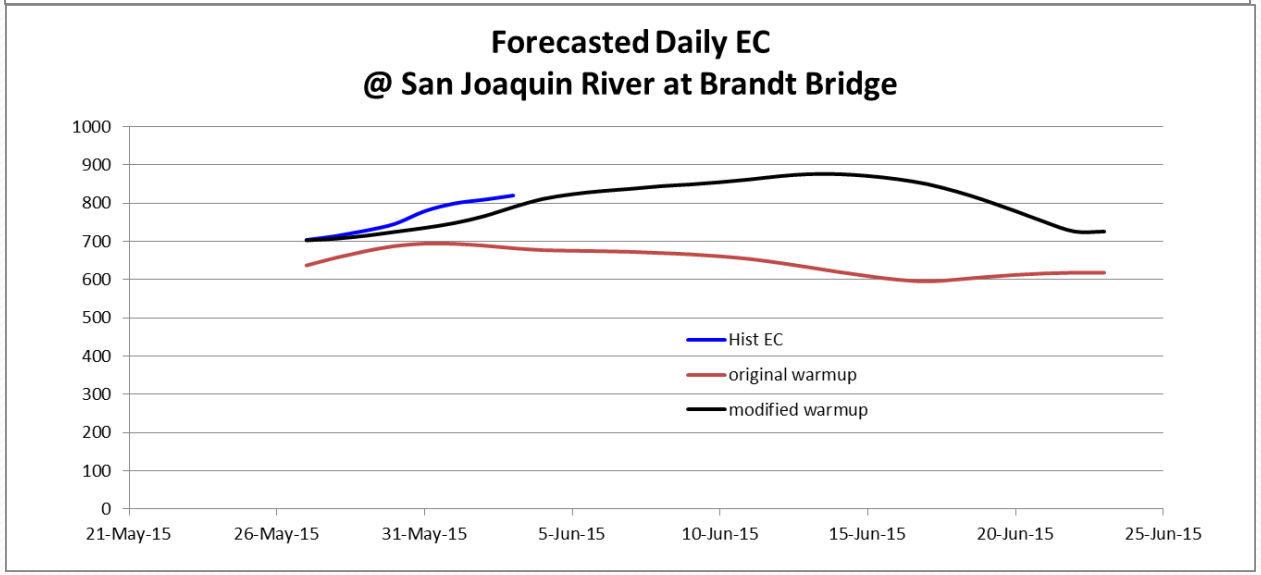
Comparison of Results





Comparison of Results





Summary

- One tool for three uses – near-term forecast, seasonal forecast and historical simulation
- Save time on downloading data from CDEC and data QA/QC
- Better forecast results for locations in the South Delta

Questions?