

Model Steering and Operating Rules

As Seen at
Asilomar!

California Water and Environmental
Modeling Forum
March 1, 2005



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Acknowledgements

DWR

Delta Modeling Section: Ralph Finch,
Bijaya Shrestha

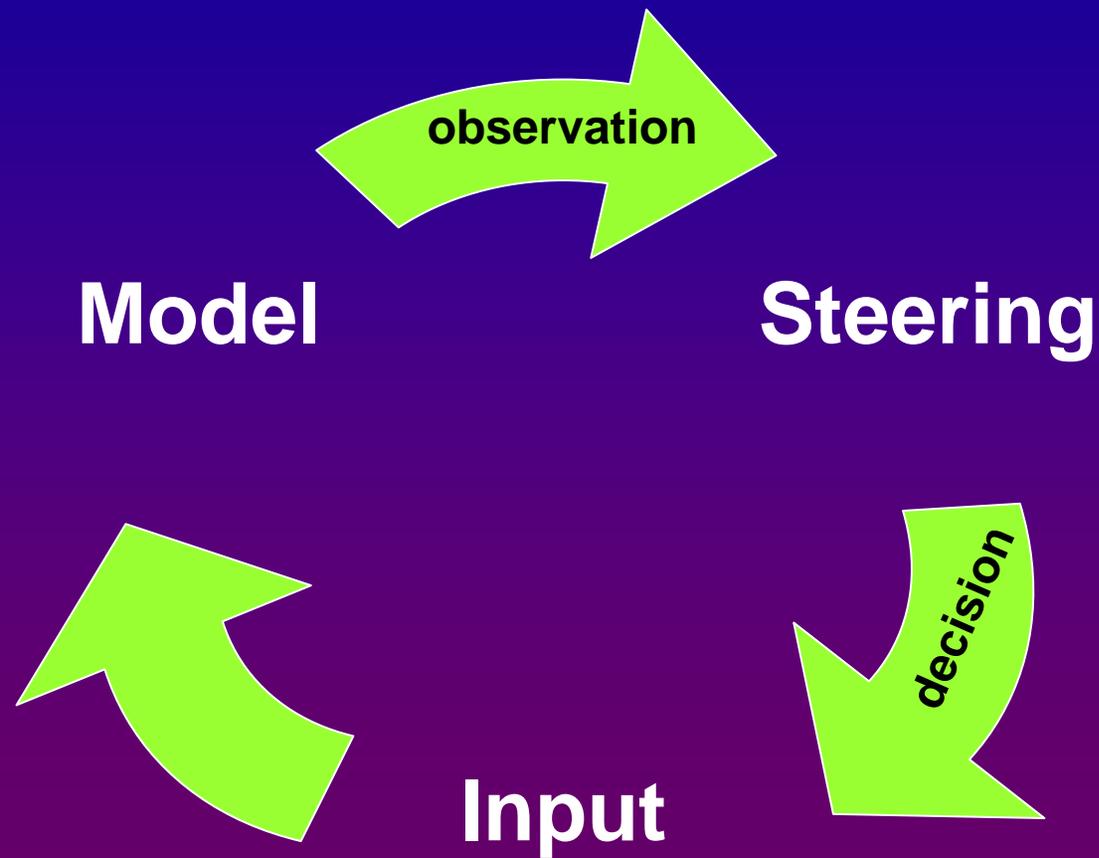
South Delta: Paul Marshall, Andy Chu

O&M: Tio Zasso, Amritpal Sandhu



What is model steering?

A way to guide a running model



Flavors of steering

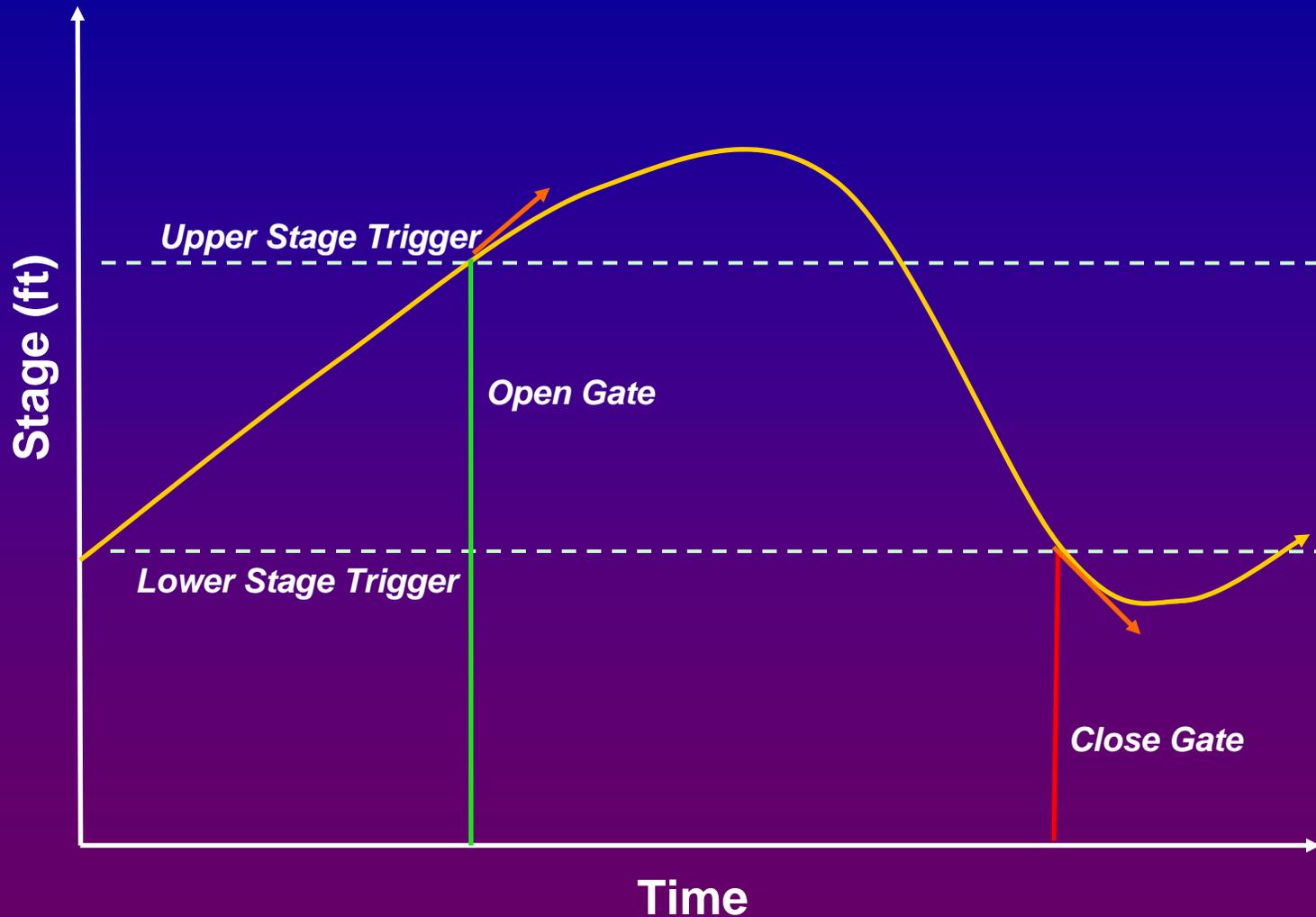


**Interactive
steering**



**Operating
rules**

Example – Operate a Gate Based on Water Levels



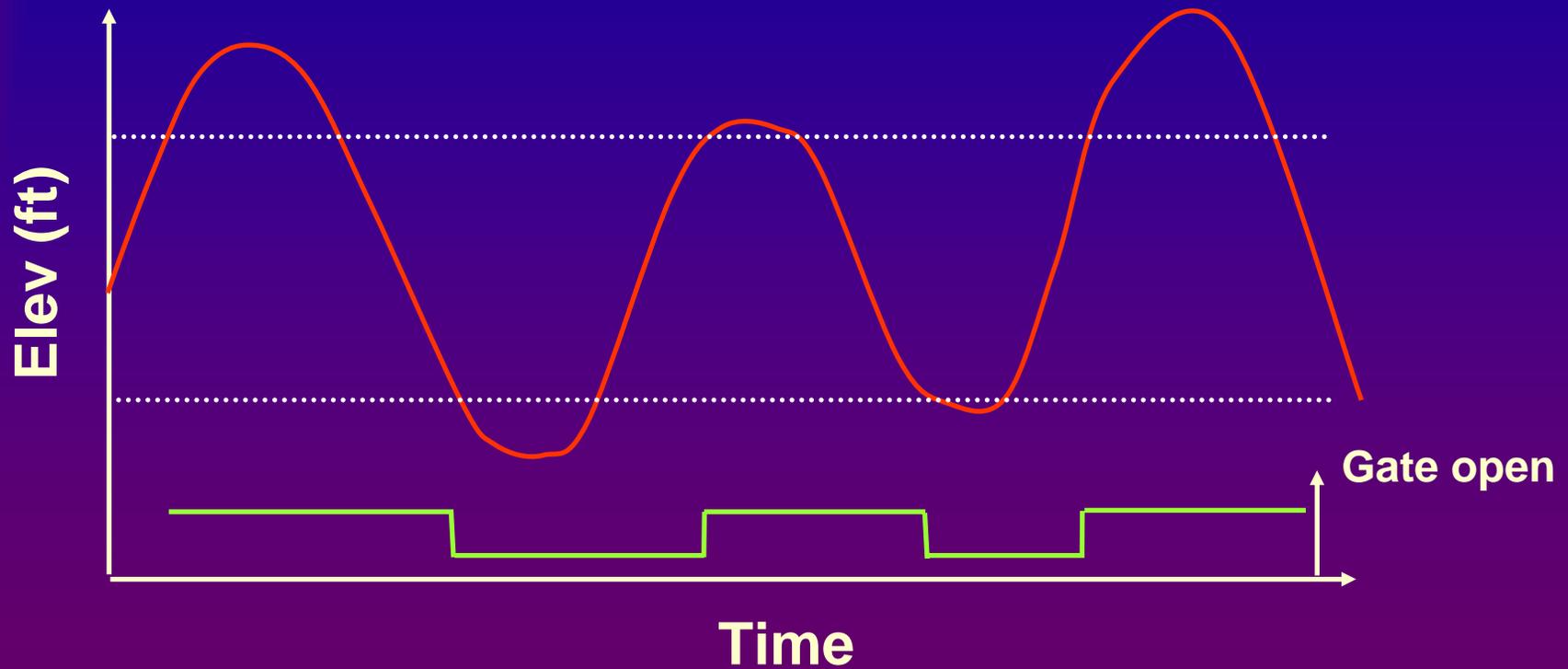
Can't we do this already?

- No
- OK, we can:
 - Code specific rules into model
 - e.g.: Montezuma, Clifton Court scouring
 - Requires programming
 - Too specific
 - Version/quality problems
 - Make offline adjustments
 - e.g.: South Delta barriers
 - Requires scripting and multiple runs
 - No interaction between rule and model

Offline Rules

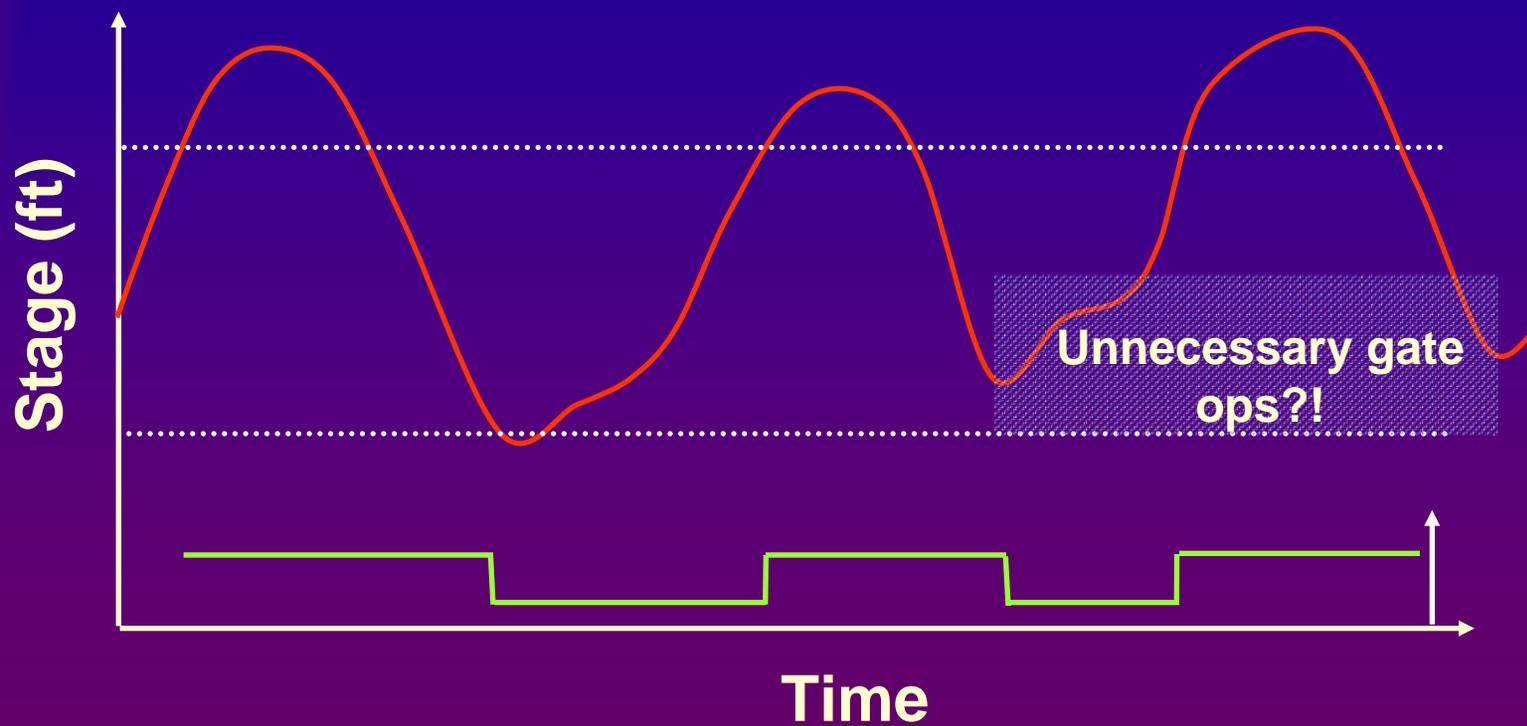
— Water surface in Channel X
(preliminary simulation)

— Weir position in Gate Y (offline)



Offline Rules: Result

- Stage (water surface elevation) in Channel X
- Weir position of Gate Y (offline)



Writing Operating Rules

- Rules expressed in simple language
- Very general trigger and action expressions based on:
 - Model variables
 - Time and season
 - Input time series

Op Rule Language Components

- **Name:** middle_river_gate_control
 - **Expressions:**
critical_stage := chan_stage(channel=132,
dist=1000) < (tide_level_ts-1.0)
ebb := chan_flow(channel=132, dist=1000) > 0.01
vamp := (month == Apr) OR (month == May)
 - **Trigger:** vamp AND ebb AND critical_stage
 - **Action:** SET gate_op(gate= "Middle River
Barrier", device = "Radial Gate") TO OPEN
-
- Model variables
- Time series
- Season

Op Rule Example in DSM2: Simplified South Delta Problem

- Operate pumps at 9000cfs
 - Curtail pumping to prevent cavitation
- Open Clifton Court gates
 - Close gates when South Delta water levels are low
- Ignore barriers (temporary barrier, always open to flow)



Save Panel Refresh Data

- Session
 - Simulation: planning-rules
 - Model: planning-rules-hydro
 - Grid
 - Parameters
 - Time Series Input
 - Initial Conditions
 - Operations
 - Operating Rules
 - Output Time Series
 - Model: planning-rules-qual

Operating Rules

Layer	Name	Action Definition	Trigger Definition
2	clifton_ct_cavitation_relax	SET qext(name="swp") TO -9000.0	cavitation_relax
2	clifton_ct_cavitation	SET qext(name="swp") TO 0.0	cavitation_onset
2	clifton_ct_sdelta_violation	SET weir_op(gate="Clifton Court", weir="Reservoir Gates") TO 0	south_delta_stage_violation
2	clifton_ct_sdelta_relax	SET weir_op(gate="Clifton Court", weir="Reservoir Gates") TO 1	south_delta_stage_relax
1	mssc_velocity_close	SET weir_op(gate="Montezuma Salinity Control", weir="Radial ga	chan_flow(channel=512,dist=0) < 0.1
1	mssc_dh_open	SET weir_op(gate="Montezuma Salinity Control", weir="Radial ga	(chan_stage(channel=511,dist=5773) - chan

Operation Time Series

Layer	Input Name	Input File	Path	Sign	Fillin

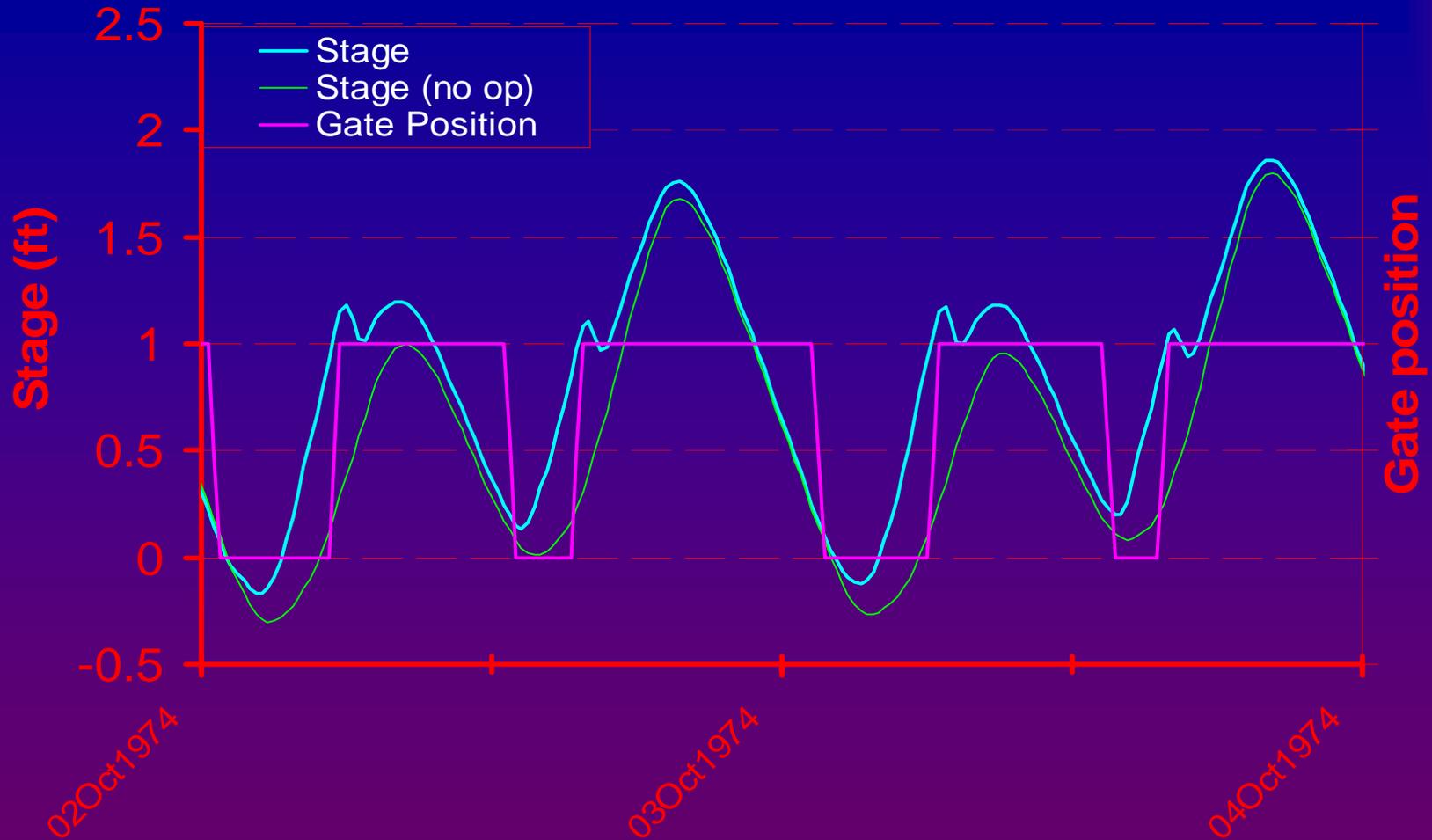
Layers

Layer	Name	
1	Montezuma Gate Ops	eli
2	Clifton Court Op Test	eli

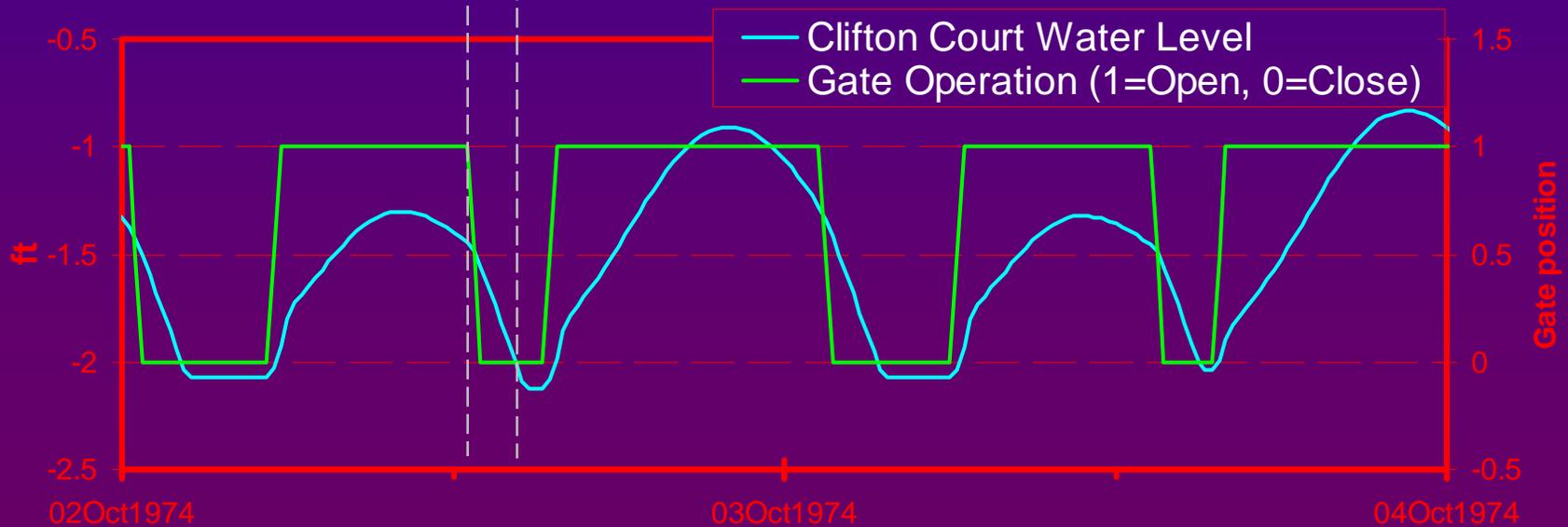
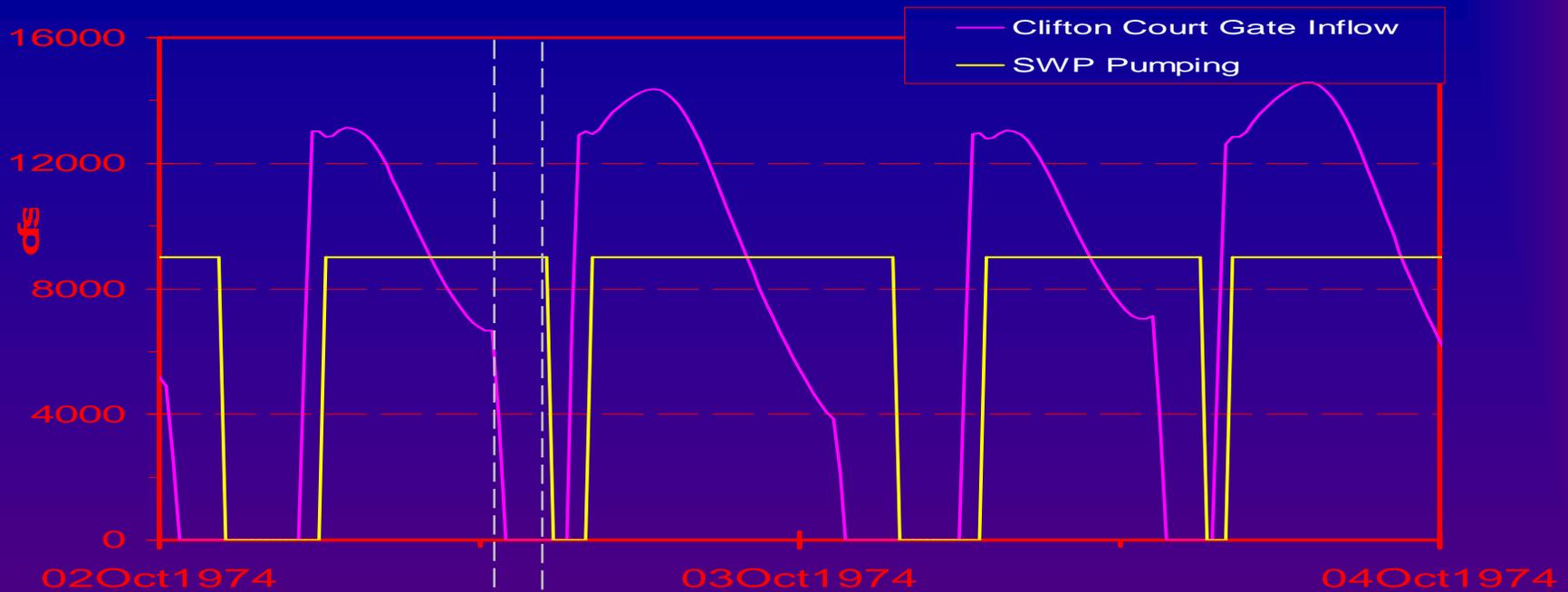
Expressions

Layer	Name	Definition
2	cavitation_onset	res_stage(reservoir="Clifton Court") < -2.0
2	cavitation_relax	res_stage(reservoir="Clifton Court") > -1.9
2	south_delta_stage_relax	chan_stage(channel=206,dist=0) > 0.5 AND chan_stage(channel=128,dist=0) > 0.5 AND chan
2	south_delta_stage_violation	chan_stage(channel=206,dist=0) < 0.3 OR chan_stage(channel=128,dist=0) < 0.3 OR chan_st

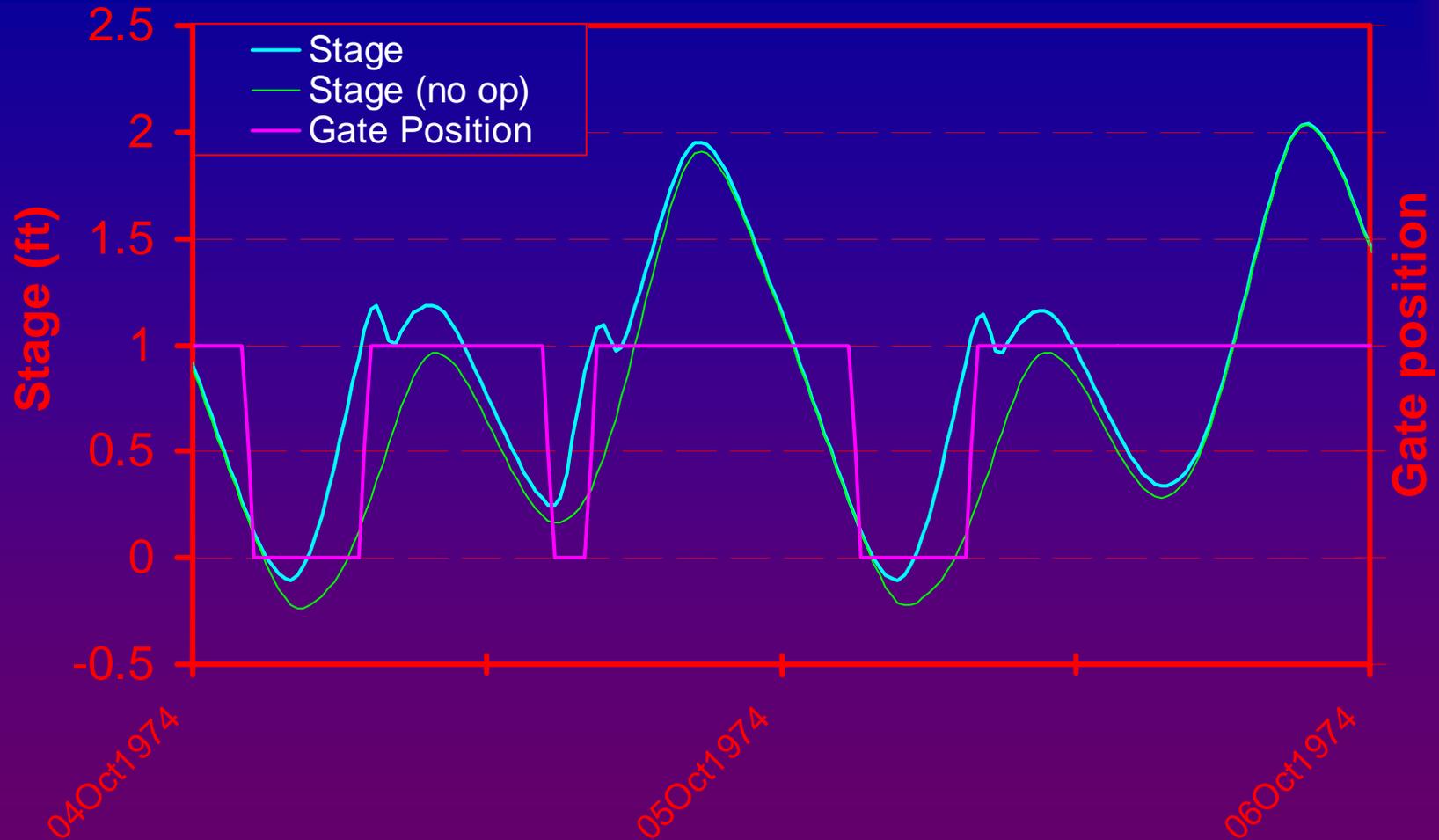
Out in South Delta



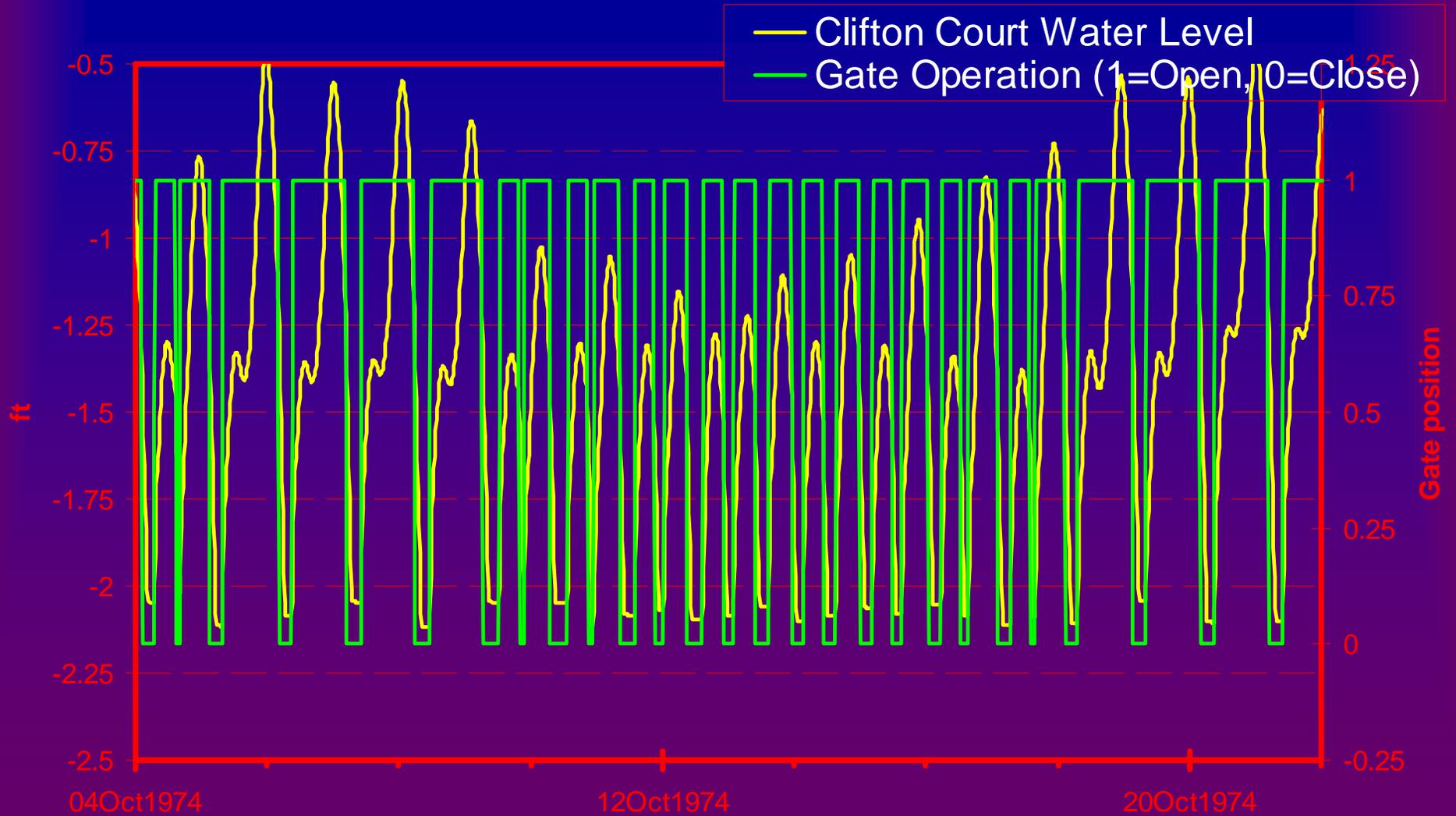
Clifton Court



Avoiding a False Op



Spring-Neap Variation



Summary

- Operating rules available in DSM2 (dbase version)
 - No qual-hydro interaction because models separate
- Rules are based on a simple language
- Good rules require virtuosity
- Ideal for gate operations and exports

For More Information

- Annual Reports 2004: Chapter 7

<http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/annualreports.cfm>

- DSM2 Users Group presentation in near future

How Operating Rules Work

- Pairs a “trigger” with an “action”
- Rule applies when trigger becomes true (e.g., stage dips below -1ft)
- Action starts (e.g. open a gate gradually)
- When action is finished, rule cleans up and deactivates
- Rules do only one thing (stage going back over -1ft does nothing)

Operating Rule Limitations

- Still a need for care and virtuosity
- In DSM2, water quality can't affect hydrodynamics

Operating Rule Goals

- Rules can react to the model
- Simple to use for simple tasks
- General enough for complex tasks
- A framework to solve problems, not a one-off solution

Operating Rules: Familiar Applications

- Montezuma Salinity Control Structure ops
- Clifton Court Gates cavitation/scouring
- South Delta barrier ops