South Delta Gate Experiments Using Operating Rules

DSM2 Users Group

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Acknowledgements

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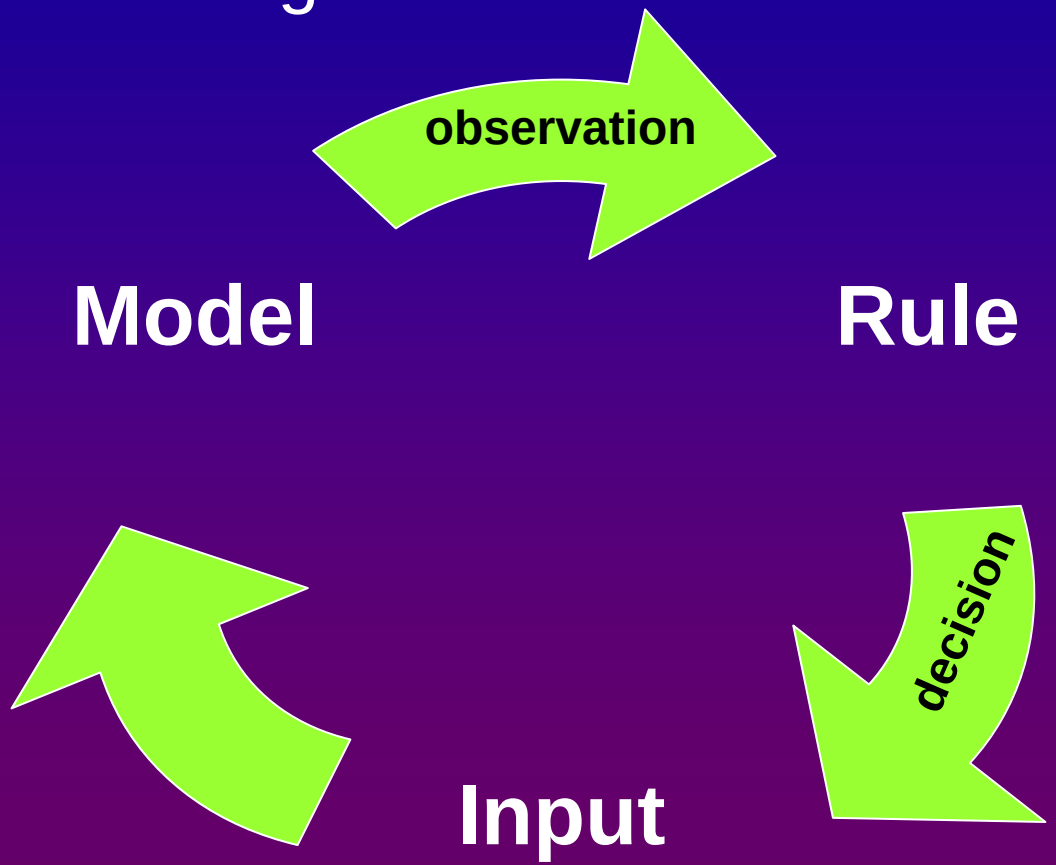
Ralph Finch, Department of Water Resources

This Talk

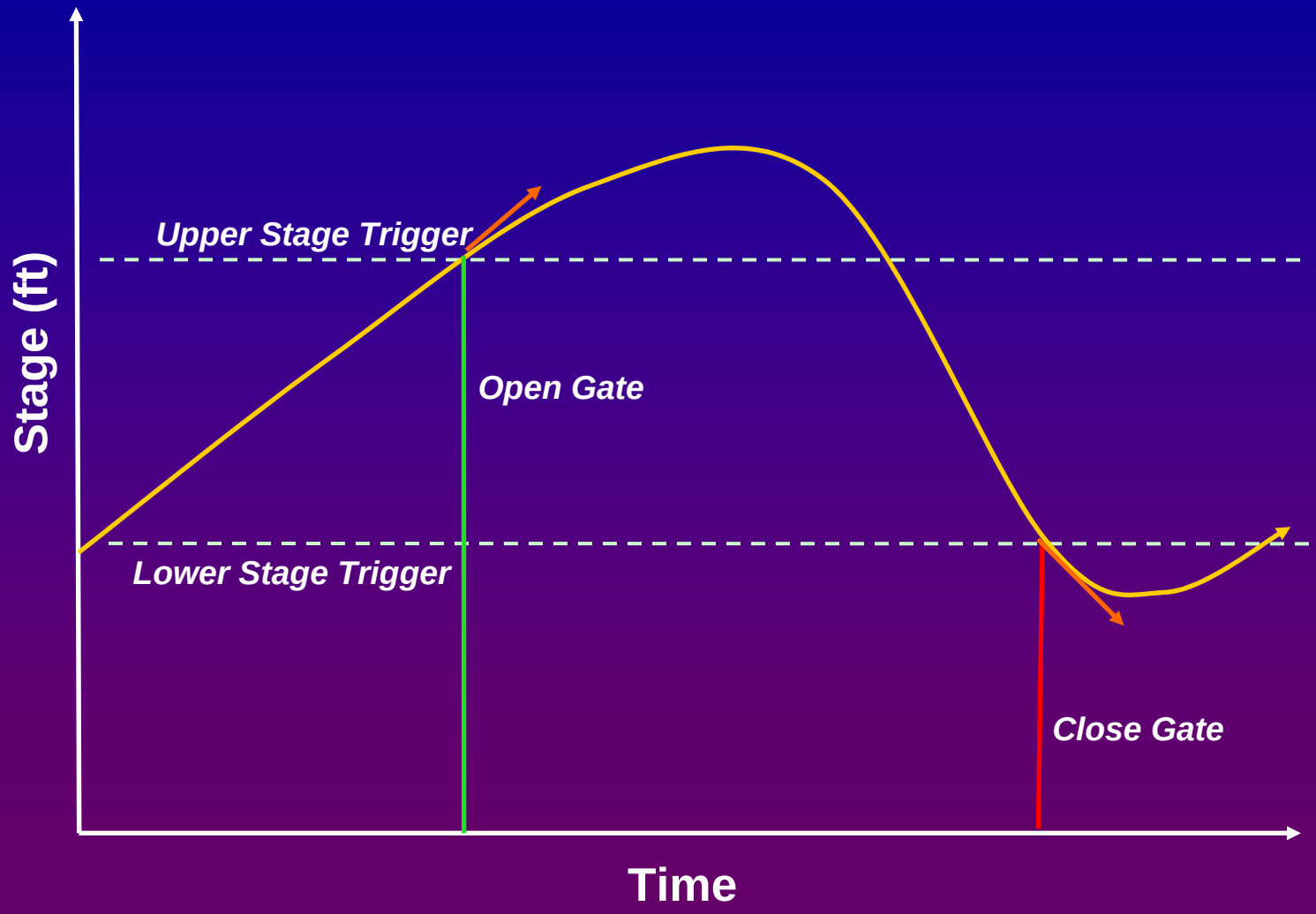
- Review of operating rules
- South Delta application
  - SDIP gates for stage protection
  - Better physical representation of gates
  - Clifton Court tidally-based gate timing
  - “Nearly production” application

What is model steering?

Use of human input/operating rules to guide to guide a running model.



Example – Operate a Gate Based on Water Levels



Operating Rule Language

- Rules expressed in simple language
  - GUI-based approach was not expressive enough
- Trigger and action expressions based on:
  - Model variables
  - Math, prediction, aggregation functions
  - Time and season
  - Input time series

Operating Rule Example

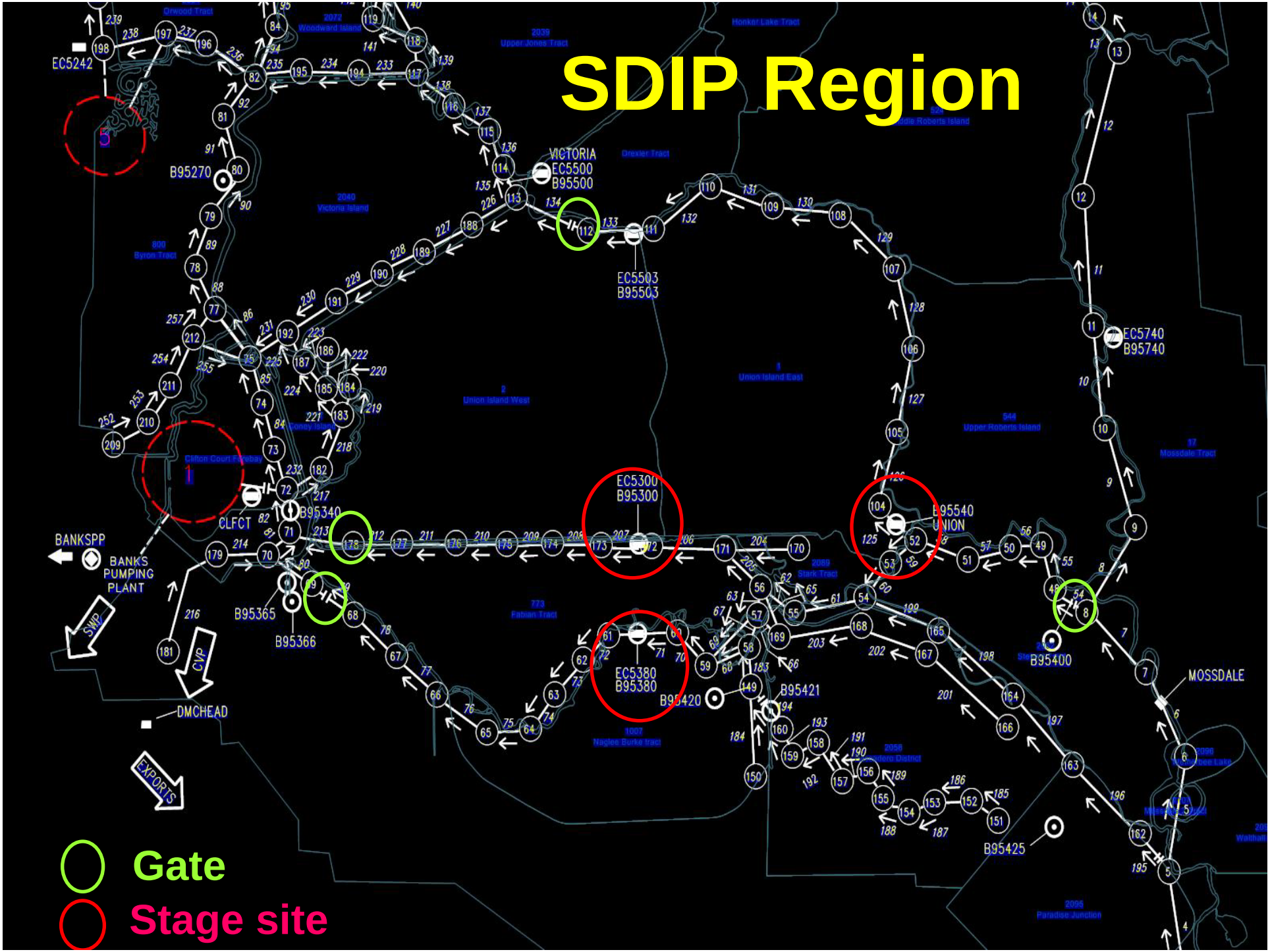
- **Name:** glc_close
- **Some expressions:**

  glc_stage_low := chan_stage(channel=207, dist=36) < 0.3

  ebb := chan_flow(channel=213, dist=0) <
  chan_flow(channel=212,dist=length)

  sjr_high := chan_flow(….) > 10000

- **Trigger:** glc_stage_low AND ebb AND NOT sjr_high
- **Action:** SET gate_pos(gate= glc, device=radial) TO 0.0


SDIP Region
EC5242
B95270
VICTORIA
EC5500
B95500
EC5503
B95503
EC5740
B95740
EC5300
B95300
B95540
UNION
B95340
CLFCT
BANKSPP
BANKS
PUMPING
PLANT
SWP
CVP
B95365
B95366
EC5380
B95380
B95420
B95421
B95400
MOSSDALE
DMCHEAD
EXPORTS
B95425
Gate
Stage site

SDIP Goals and Metrics

- Small critical stage (Z < 0) frequency at 3 sites
- Tom Paine water levels (not yet)
- Low average stage
- Water quality and water level statistics:
  - CCFB
  - Channel (Middle R, GLC, Old R)
- Number/length of gate openings

SDIP Study Goals/Questions

- Compare rule vs flow-based gate ops
- How many SDIP gates/marginal return?
- Gates with movable weir bottom
- Determine rule criteria/parameters
- Role of Clifton Court gates
- Minimum “leakage” at Old@Head

SDIP Rules (Critical Stage)

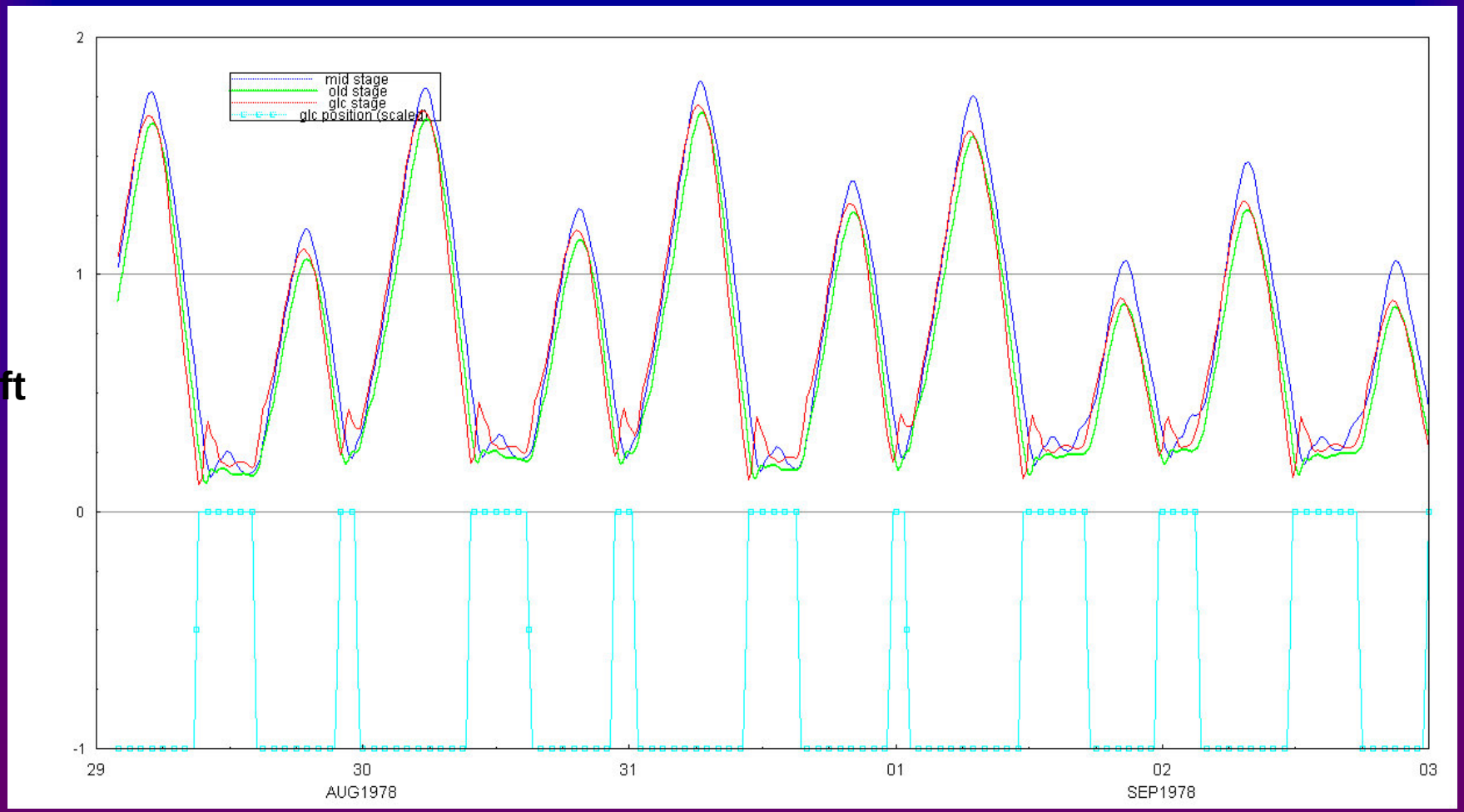
- Close when stage is low and ebb
- Open when stage is high or flood
- If SJR flow >10,000cfs: open always
- Q: OWN channel low or ANY low?
- Q: thresholds/periods/levels?

Flow-Based (Plan C) ops

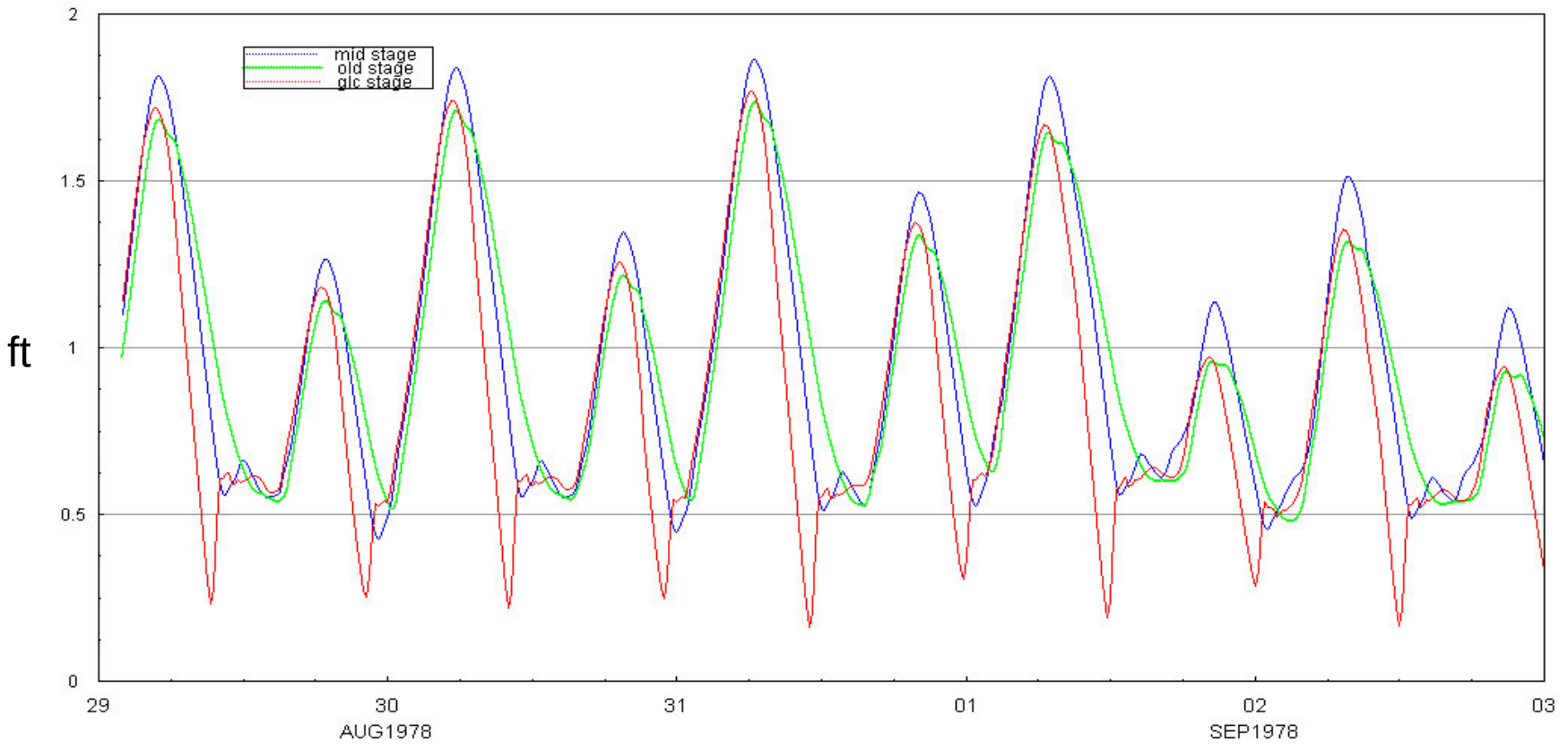
- Old and Mid always open to flood
- Old and Mid closed to ebb during low flow or vamp, else open (unidirectional)
- SJR > 10000: open always
- Grantline is op rule (stage) based except open when SJR > 8000

Plan C & Op Rules similar

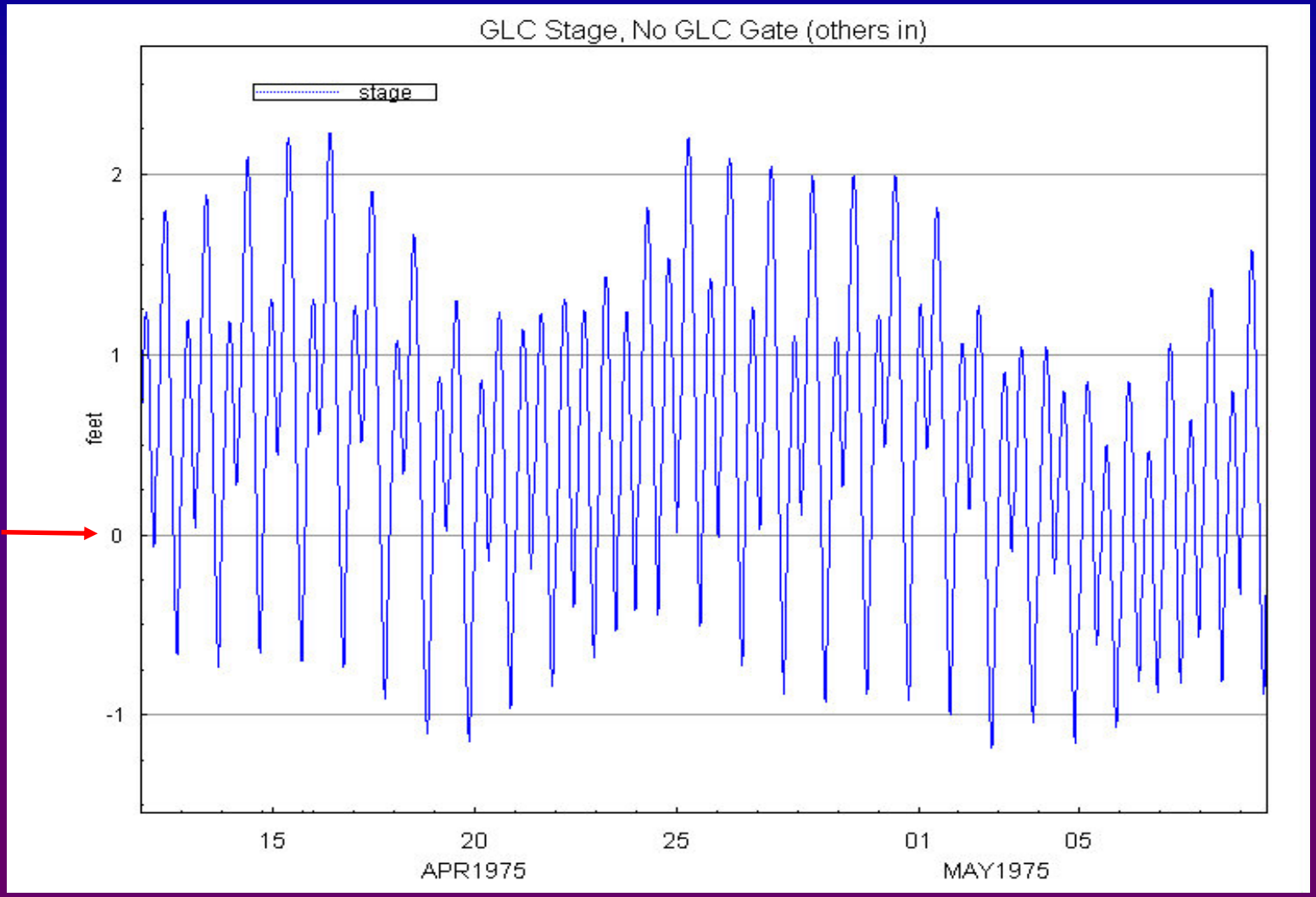
Rule-Based Op (GLC)



Flow-Based Op Results



Eliminating GLC Gate



min elev

Clifton Court

- South Delta LL ALWAYS during time when CCFB stage > outside.
- Priority 3 is same as Priority 4 during LL
- Priority 3 extends into following high
- The big question: Is this good?
  - Levee protection (want average stage low)
  - Tom Paine Slough (want stage high)
- Probable answer: ops vary on spring-neap

Clifton Court Gates

- Priority 3: tidal timing
- Priority 4: open to incoming flow, else closed
- Experiments with 2 hour closures around the clock

CCFB Priority Schedule

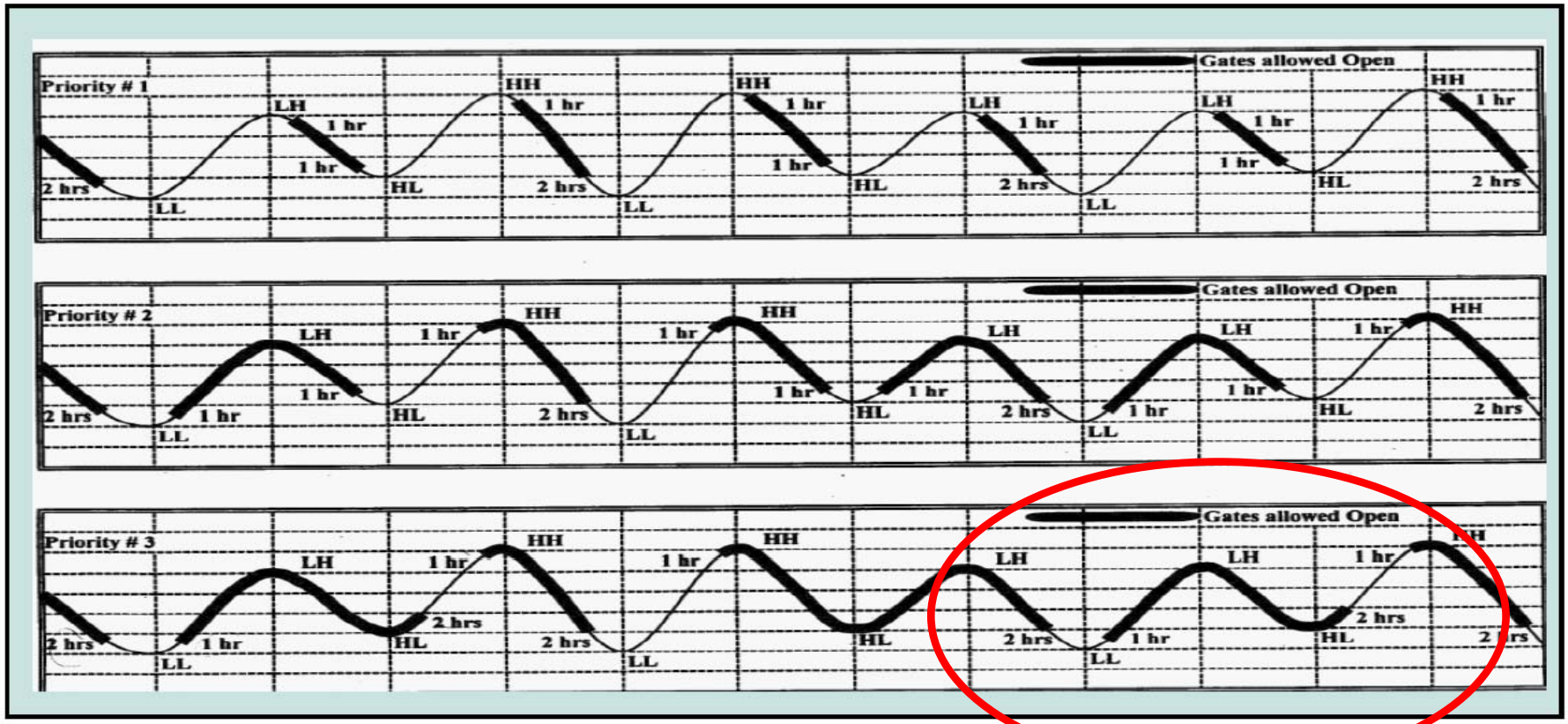
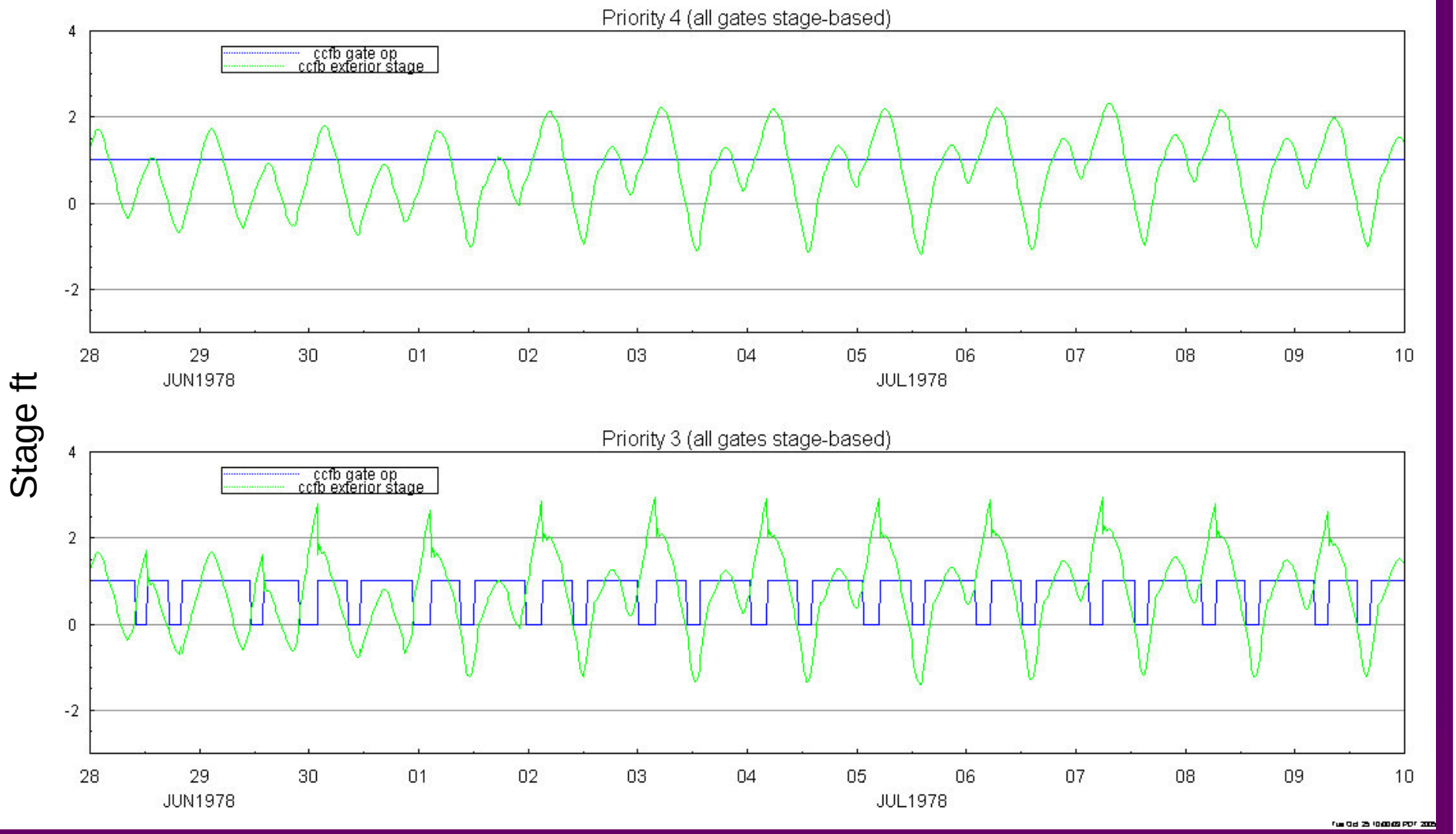


Figure 12.2: Clifton Court Forebay Gate Priority Operation Rules

Priority 3 vs 4: DSM2 practice

Priority 3 vs 4



Mining the data …300yrs of simulations

	GLC below barrier mean stage	Old R Tracy mean stage	CCFB mean stage	GLC below barrier stage < 0 freq (d/yr)	Old R Tracy stage < 0 freq (d/yr)	Mid R frac close	CCFB mean ec umhos/cm	Old@Tracy mean ec umhos/cm
gmo_any_c3_norelax	1.129	1.031	0.619	0.000	0.312	0.247	487.808	633.033
gmo_any_c3_relax	1.068	0.990	0.623	0.018	0.312	0.235	487.520	633.470
gmo_any_c4_norelax_leak01	0.822	0.847	0.896	69.957	42.171	0.248	488.051	574.057
gmo_any_c4_relax.dss	1.040	0.971	0.936	0.036	0.331	0.224	486.528	635.087
gmo_own_c4_relax	1.012	0.939	0.929	1.429	1.528	0.125	486.468	613.814
gmo_flow_c4_relax	1.211	1.289	0.971	0.000	9.040	0.340?	489.923	539.925
mo_any_c4_norelax	0.834	0.856	0.902	68.114	40.368	0.247	486.066	579.361

Early results

- Op rules open less than flow-based rules
- Op rules may eliminate stage violations
- Flow-based has better Old@Tracy EC
- Ops can be local – main thing that helps GLC stage is GLC gate