Overview of OASIS

Ecological Flows Science Advisory Board

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November 27, 2012

Advancing the Management of Water Resources

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www.hydrologics.net

Topics

- What is OASIS?
- Inflow development/verification
- Strengths
- Weaknesses

What is OASIS?

- A patented, mass balance, water resources simulation/optimization model
- Runs on a daily timestep with a 75+ year period of hydrologic record
- Runs in two modes
  - Simulation
  - Position Analysis
- Purposes:
  - Alternatives evaluation (planning/finding balance)
  - Real-time operations (following the plan)
  - Gaming

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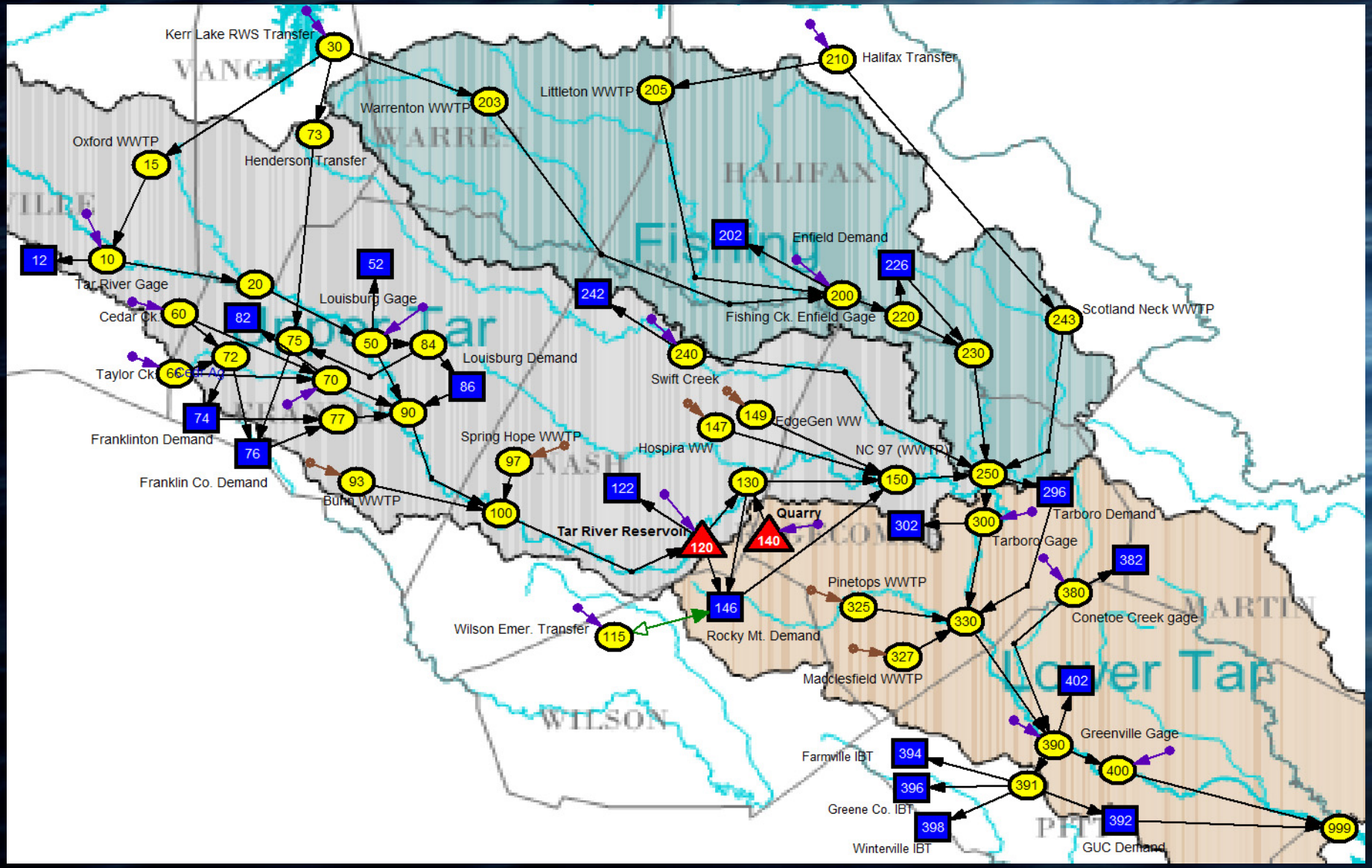
Nodes and Arcs



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Model Input

- Time series data
  - Unregulated inflows
  - Evaporation
  - Precipitation
- Static data
  - Physical data
    - Reservoir SAE, turbine characteristics, channel capacities, etc.
  - Withdrawals, discharges, demands
- Operating Data, e.g.
  - Rule curves
  - Minimum releases/environmental flows
  - Drought and flood management policies
  - Energy requirements

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Model Output

- Tables and Graphs of
  - Flow
  - Elevation, and
  - *Derived attributes,* e.g.habitat availability, energy, revenue, water supply shortages, recreation days

for every time step

at every point in the system

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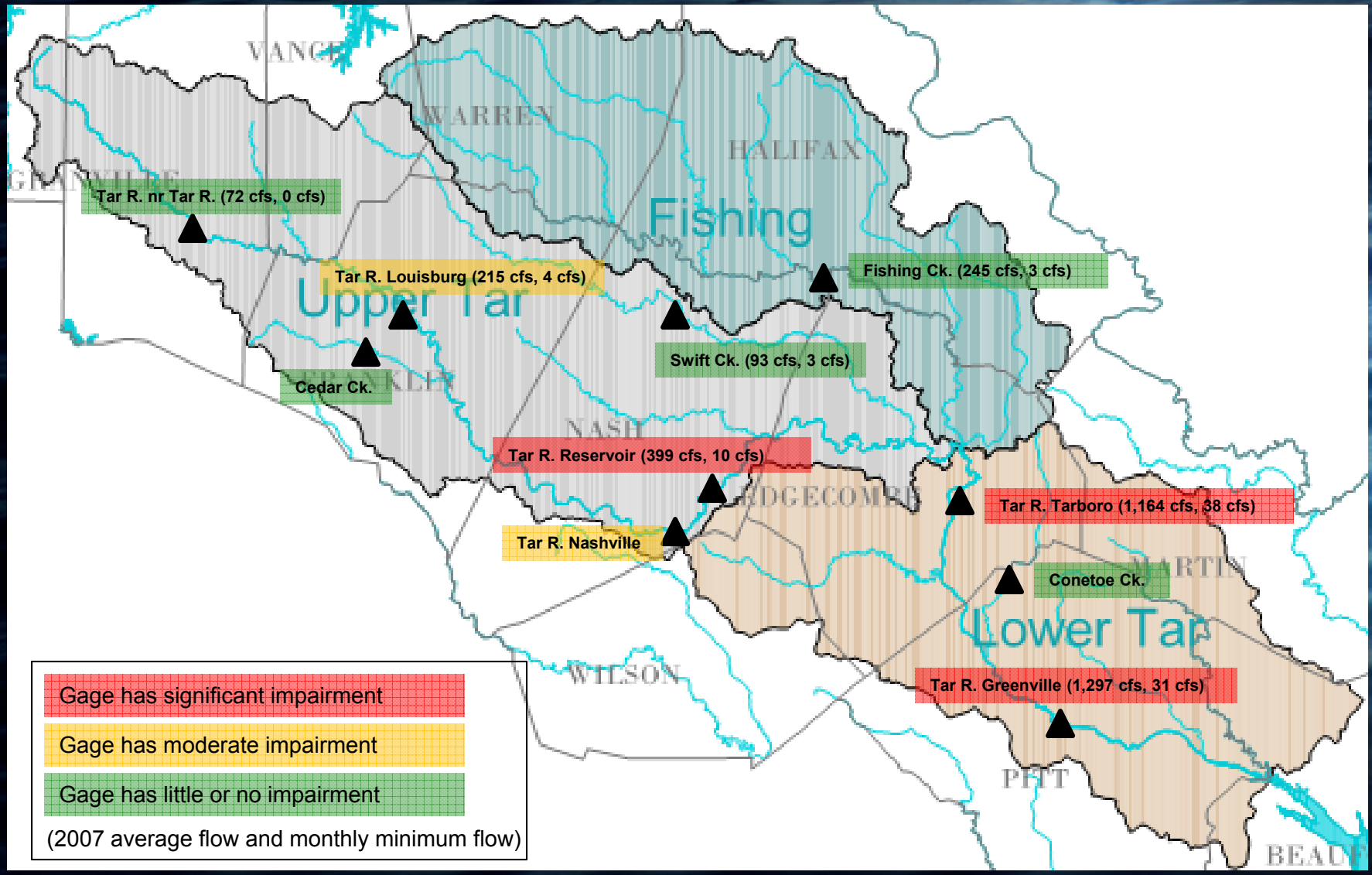
Inflow Development

- Unimpaired (unregulated, unaltered) inflows necessary for evaluating alternative facilities, operating policies and demand levels
- Impairments include water withdrawals/discharges and reservoir regulation (including net evaporation)
- Methodology: Force inflows to match monthly unimpaired gage flows; disaggregate to daily based on a proximate unimpaired gage

Gages Used

USGS Number	Description	Period of Record	Drain. Area
02081500	TAR RIVER NEAR TAR RIVER, NC	10/1939-present	167
02081747	TAR R AT US 401 AT LOUISBURG, NC	10/1973-present	427
02081800	CEDAR CREEK NEAR LOUISBURG, NC	10/1956-09/1975	47.8
02082000	TAR RIVER NEAR NASHVILLE, NC	10/1928-01/1971	701
02082506	TAR R BL TAR R RESERVOIR NR ROCKY MOUNT, NC	08/1972-present	777
02082770	SWIFT CREEK AT HILLIARDSTON, NC	08/1963-present	166
02082950	LITTLE FISHING CREEK NEAR WHITE OAK, NC	10/1959-present	177
02083000	FISHING CREEK NEAR ENFIELD, NC	10/1926-present	526
02083500	TAR RIVER AT TARBORO, NC	10/1931-present	2,183
02083800	CONETOE CREEK NEAR BETHEL, NC	12/1956-06/2002	78.1
02084000	TAR RIVER AT GREENVILLE, NC	04/1997-present	2,660

Gage Map



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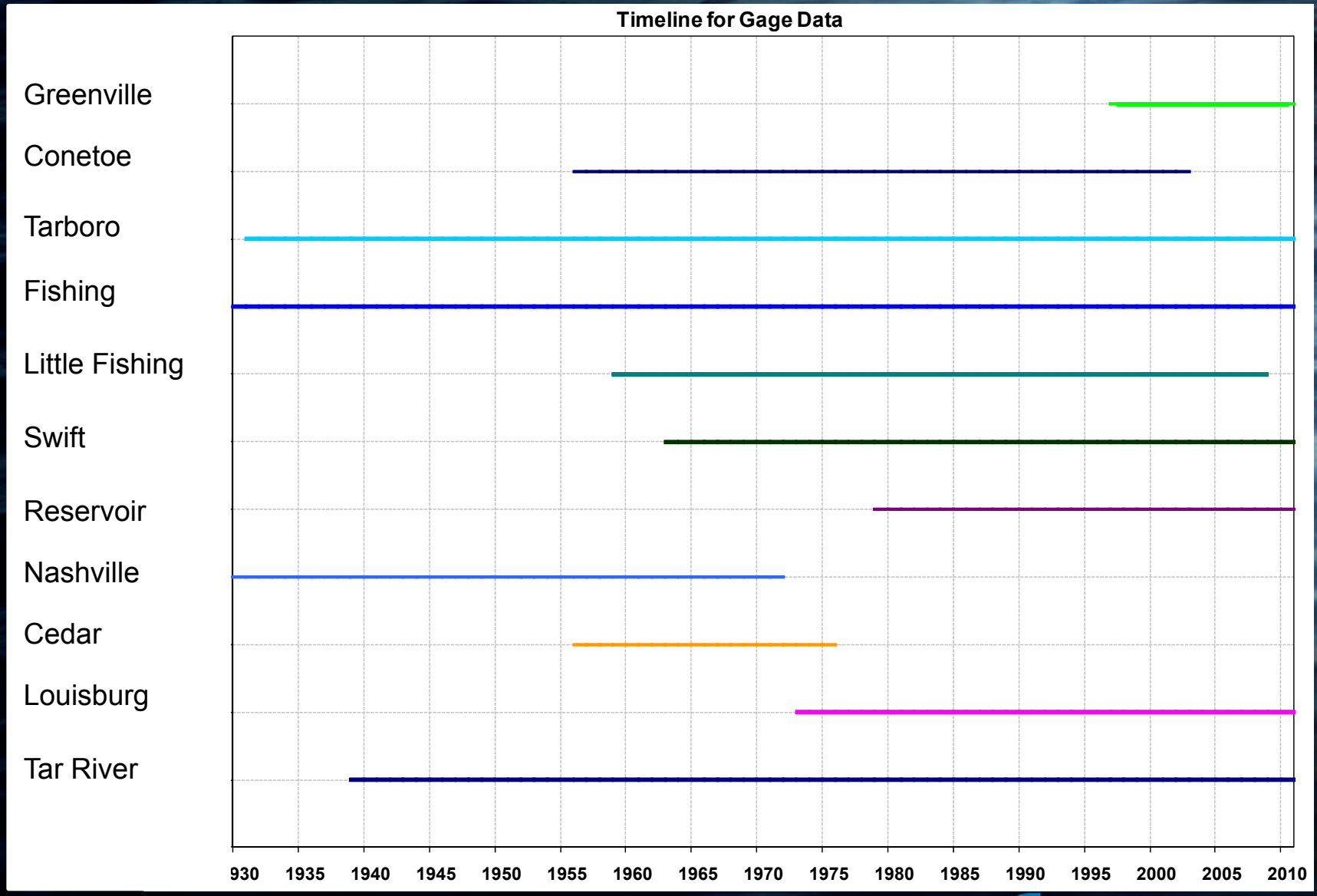
Gage Timeline



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Unimpairing Inflows

- Instream nodes (e.g., stream gaging sites)
  - Adjust inflows for upstream withdrawals and returns
- Reservoirs
  - Use drainage-area adjusted, unimpaired stream gages immediately upstream
  - Otherwise, back-calculate from reservoir outflows and change in storage, adjust for upstream impairments

Developing Inflows (cont'd.)

- Inflow records modified to eliminate negatives caused by time of travel issues and errors in impairments
- Fill in missing inflow records by correlating with unimpaired inflows at other nodes
  - USGS Fillin program computes correlations on a monthly basis
  - Filled-in records must be scaled to ensure that actual unimpaired flow at downstream points is preserved
- Monthly flows/gains disaggregated to daily flows using local unimpaired gage to preserve natural variation
  - Impairment data is often only available on a monthly average, and can cause noise on a daily basis
  - Tidal influence at Greenville can impact daily readings
  - Goal: to build daily flows whose variation is representative of history while preserving monthly gage flows as ground truth

Spreadsheet Showing Gage

02082506 - Tar R BL Tar R Reservoir nr Rocky Mt - All flows in cfs unless otherwise noted								
	Reservoir		WW Discharges	Withdrawals				
	Tar R. Res	Tar R. Res	RM	RM	Total	Total Adjustment	Below Tar	Unregulated
	Change		Tar R.	Tar R.	Adjustment	Upstream	River	Tar River
	in	Net	Res.	Res.	this		Reservoir	Reservoir
Date	Storage	Evap	Return	WD	Subbasin		gage	inflow
8/5/2006	-107.4	7.4	1.5	15.8	-85.7	-72.3	152.0	**79.7**
8/6/2006	-107.4	7.3	1.1	15.6	-85.6	-72.1	133.0	**60.9**
8/7/2006	0.0	0.0	0.7	13.5	12.7	26.3	122.0	**148.3**
8/8/2006	0.0	7.2	1.0	13.0	19.1	32.4	111.0	**143.4**
8/9/2006	0.0	7.2	1.1	13.5	19.7	33.0	99.0	**132.0**
8/10/2006	0.0	-33.9	0.4	4.6	-29.7	-16.5	106.0	**89.5**
8/11/2006	214.8	7.2	0.9	10.3	231.4	244.8	190.0	**434.8**
8/12/2006	-107.4	7.4	1.6	15.4	-86.2	-78.9	177.0	**98.1**
8/13/2006	0.0	7.3	1.3	15.5	21.5	29.0	149.0	**178.0**
8/14/2006	-107.4	7.3	1.0	12.7	-88.4	-81.1	127.0	**45.9**
8/15/2006	0.0	7.2	0.6	15.3	21.9	29.1	109.0	**138.1**
8/16/2006	-107.4	7.2	0.9	12.5	-88.6	-81.8	89.0	**7.2**
8/17/2006	0.0	7.1	1.1	13.0	18.9	25.3	79.0	**104.3**
8/18/2006	0.0	7.1	1.2	14.1	20.0	26.5	73.0	**99.5**
8/19/2006	0.0	7.1	1.1	15.4	21.4	30.9	83.0	**113.9**
8/20/2006	0.0	7.1	1.1	15.4	21.4	31.3	79.0	**110.3**
8/21/2006	0.0	7.1	1.1	13.5	19.5	29.3	67.0	**96.3**
8/22/2006	0.0	3.0	0.9	13.3	15.5	25.2	64.0	**89.2**

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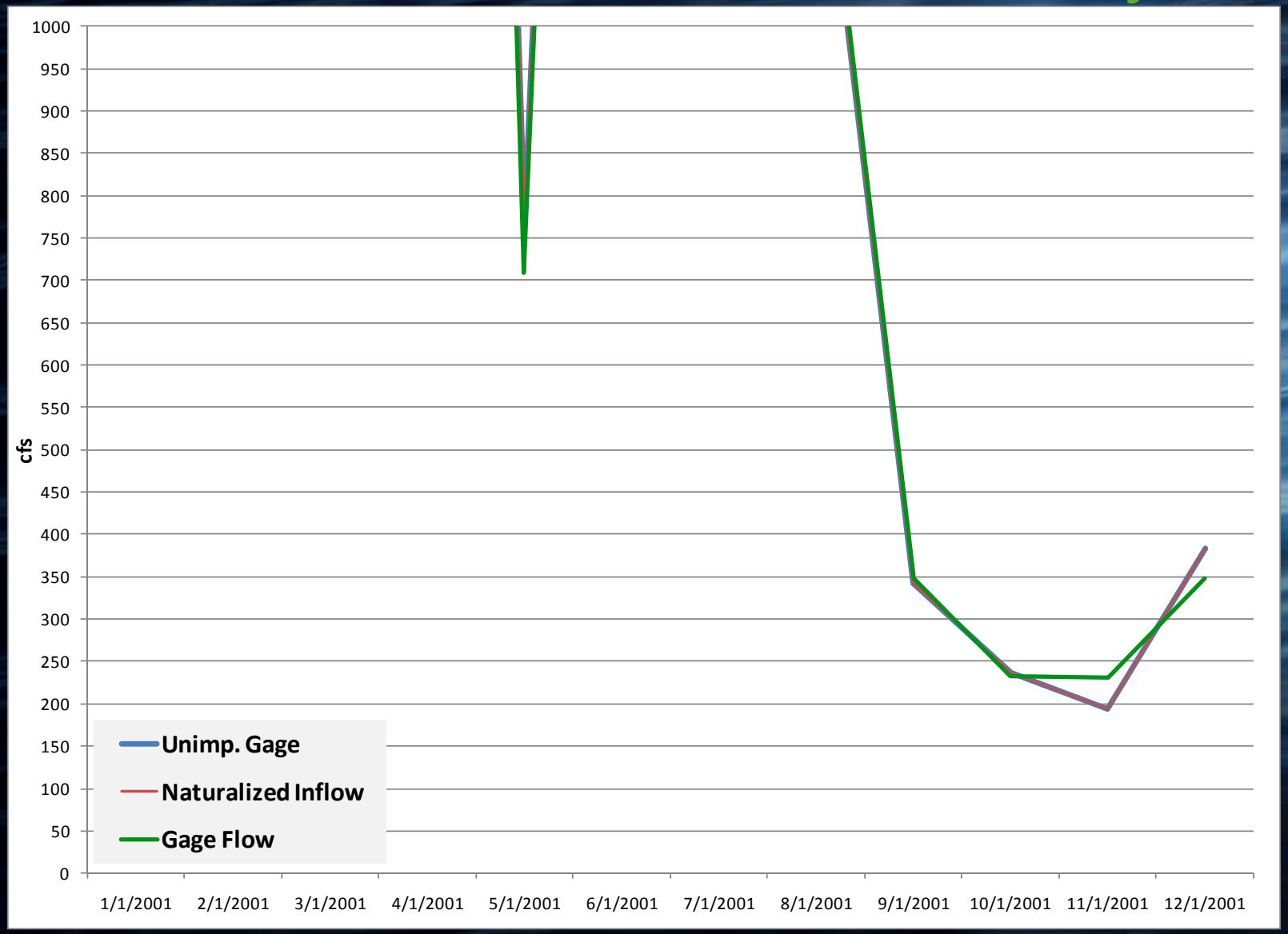
Verification -Tarboro Flow, Monthly



Unimpaired Gage = daily gage flow adjusted for impairments upstream
Naturalized Inflow = monthly unimpaired gage flow disaggregated to daily to preserve natural variation

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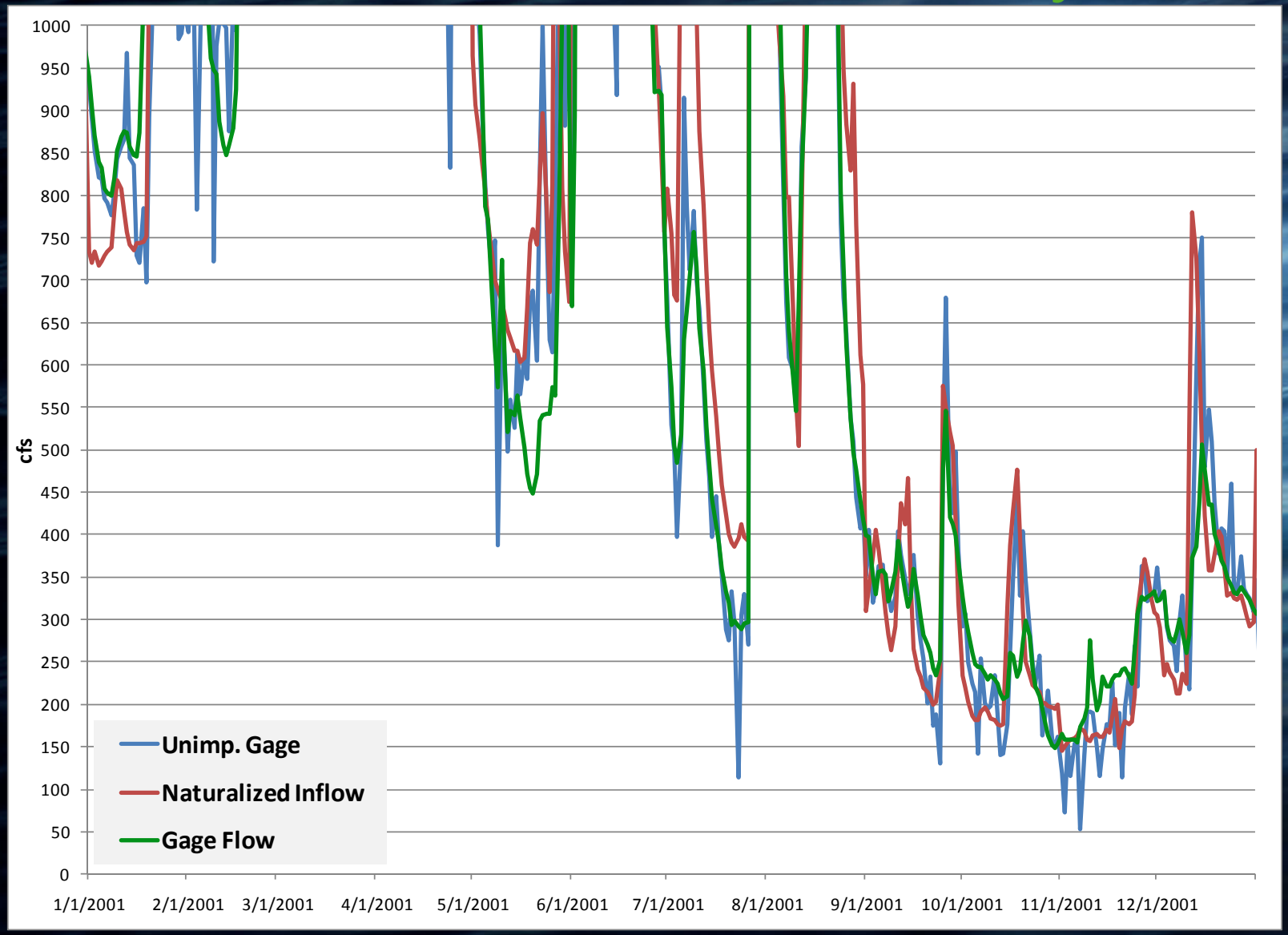
Verification - Tarboro Flow, Daily



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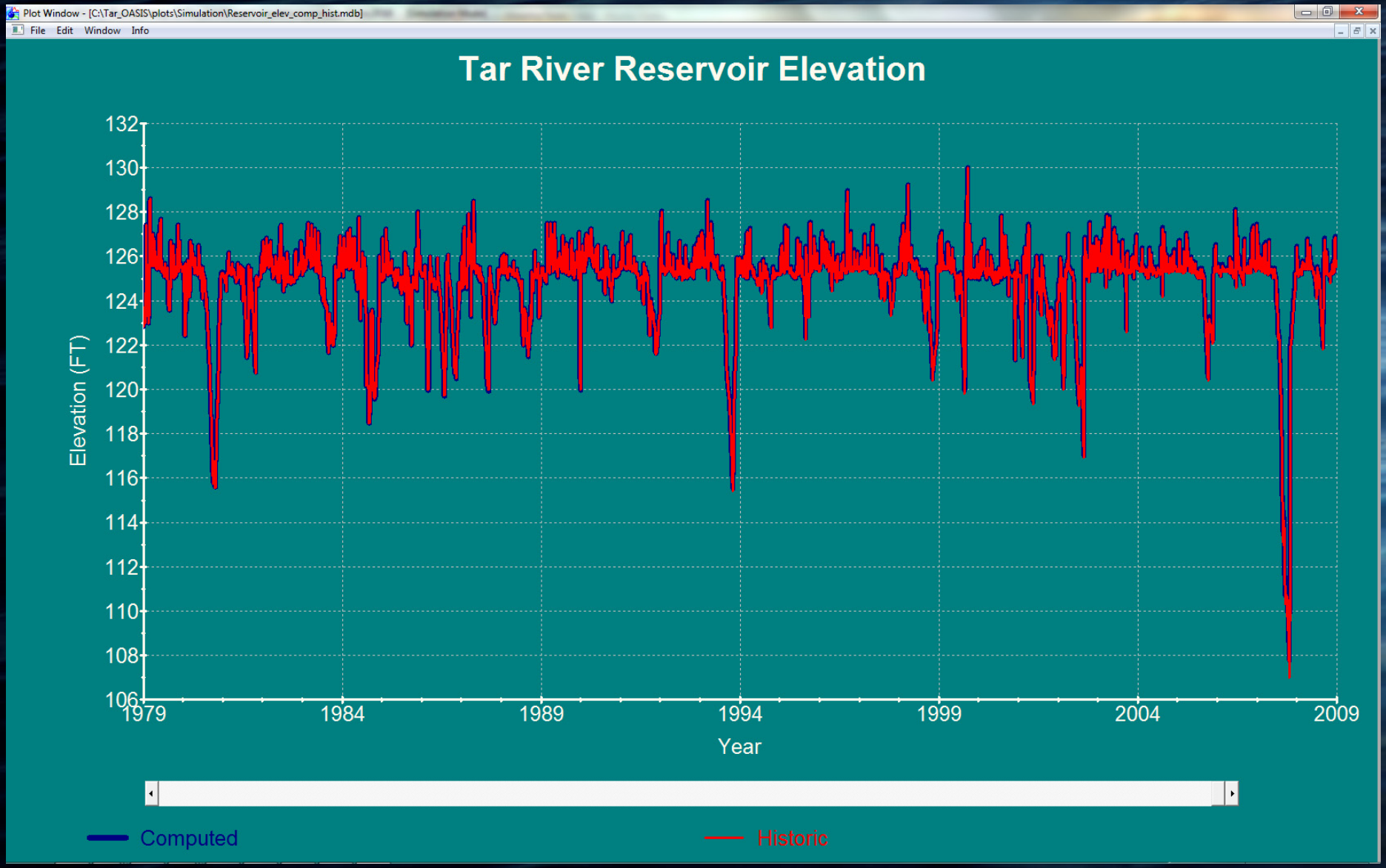
Verification – Tar River Reservoir



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Strengths

- A systems approach
  - All management aspects captured, including WSRP
  - Allows for investigation of creative solutions
- It's fast
- It's easy to use
- Can be linked to other models
- Nodes and arcs can be added after the model is "done"

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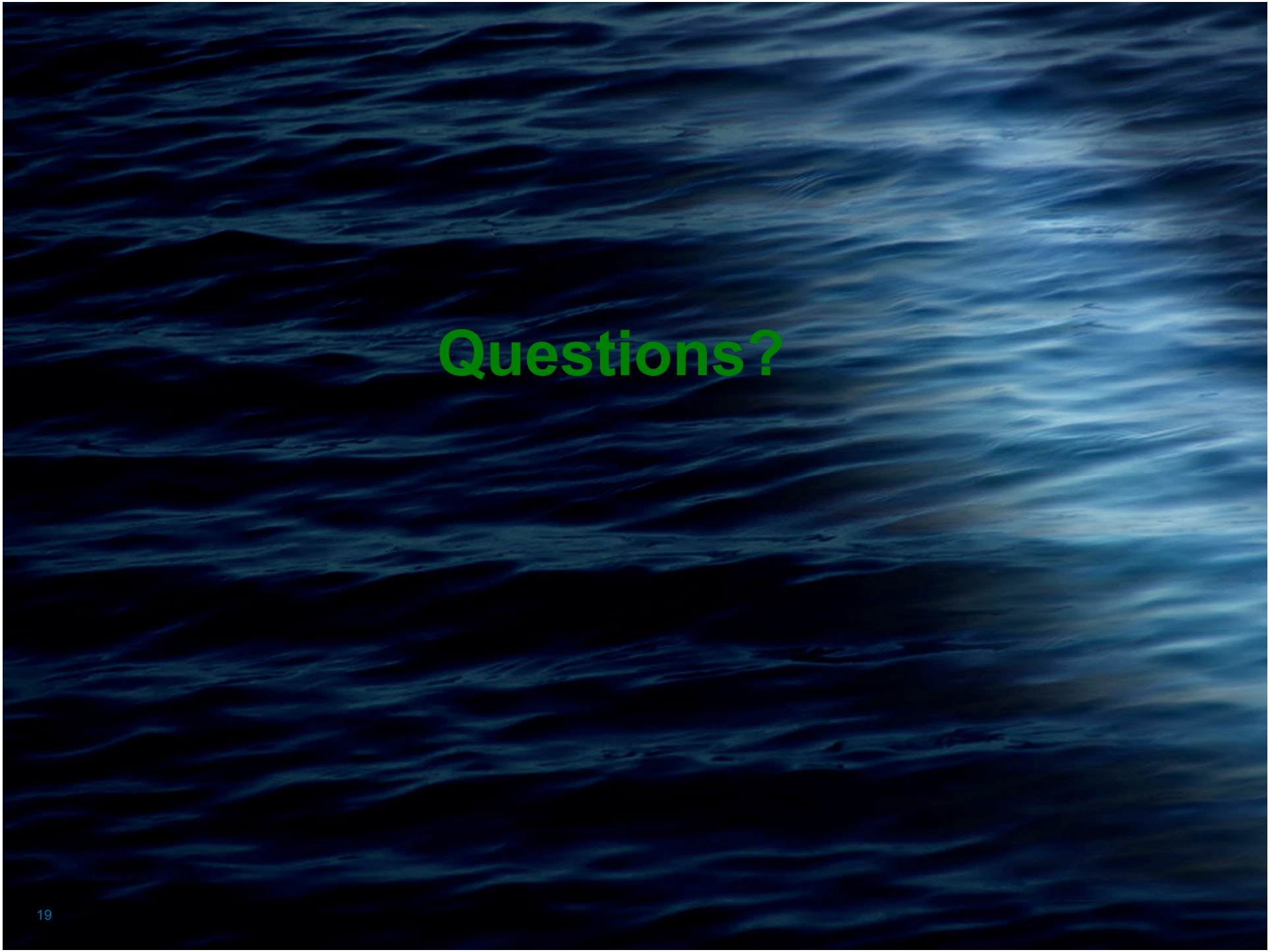
Weaknesses

- No output between inflow nodes
- Not appropriate for flood routing
- Stationarity ?


Questions?