

Progress report on DO and SAV/Water Clarity attainment for P6 scenarios based on the current P7 estuarine model and assessment procedures

**Richard Tian, Lewis Linker
and modeling team**

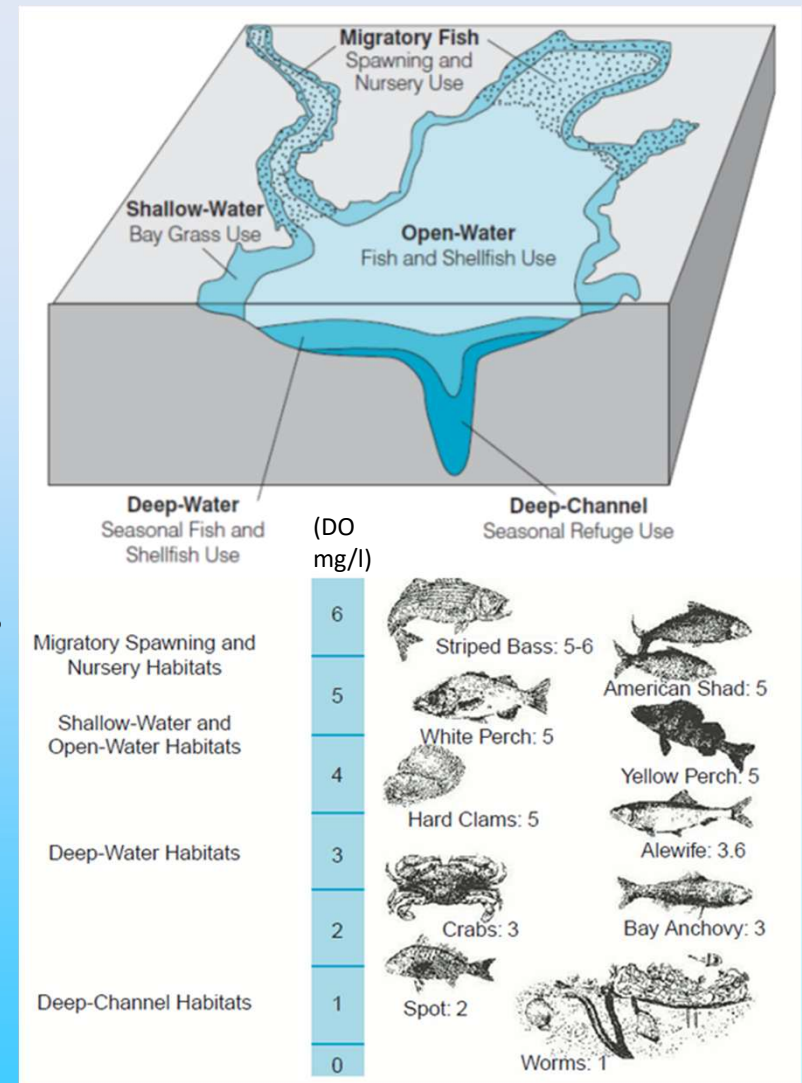
Modeling Quarterly Review Meeting

Annapolis, Jul. 15, 2026

Designated Uses (DUs)

Six DUs:

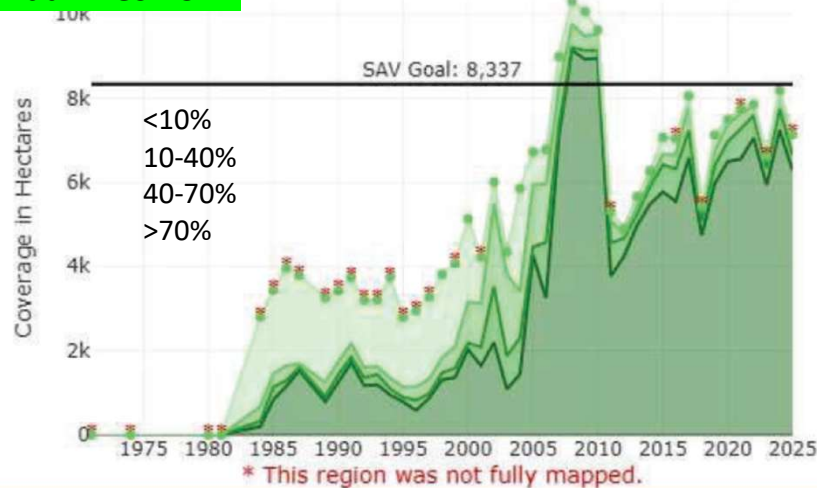
- **DO DC:** deep channel.
- **DO DW:** deep water.
- **DO OW:** open water.
- **DO MSN:** migratory fish spawning and nursery.
- **Chlorophyll:** James and Anacostia rivers.
- **SAV and Water clarity:** Shallow waters.



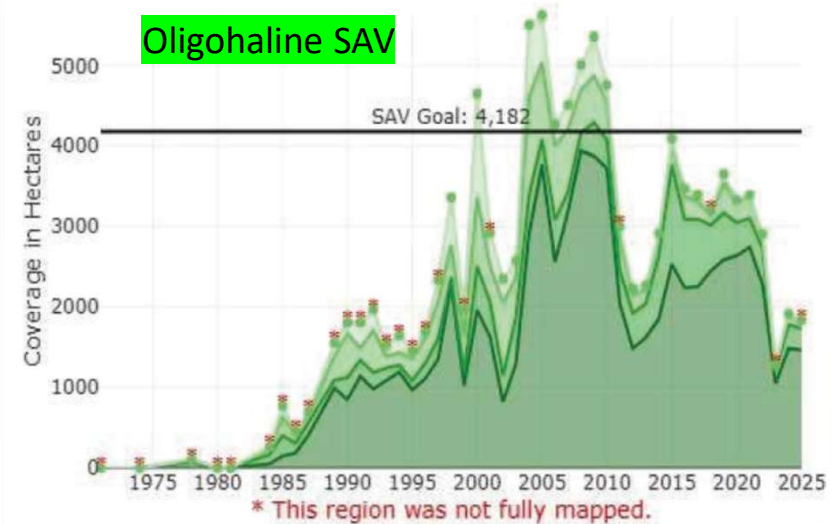
SAV trend

(slide provided by Lewis Linker from VIMS webpage)

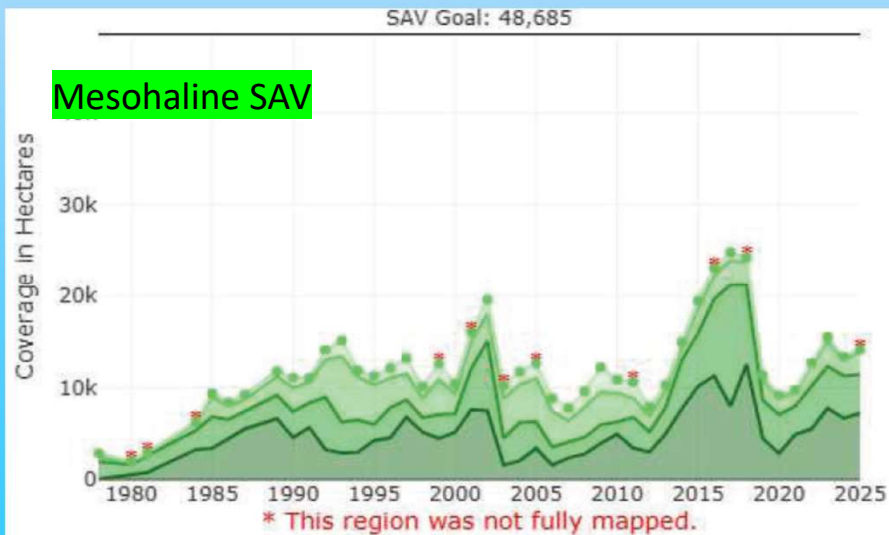
Tidal Fresh SAV



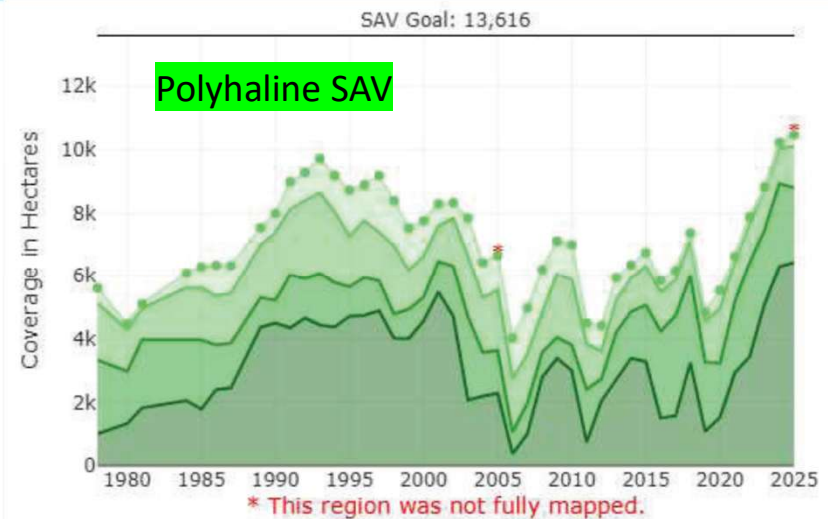
Oligohaline SAV



Mesohaline SAV



Polyhaline SAV



Water clarity (K_d) criteria

b) Table 1. Numerical Water Clarity Criteria (in Secchi Depth Equivalents) for General Application to Shallow Water Aquatic Vegetation Bay Grass Designated Use (Application Depths Given in 0.5 Meter Attainment Intervals¹).

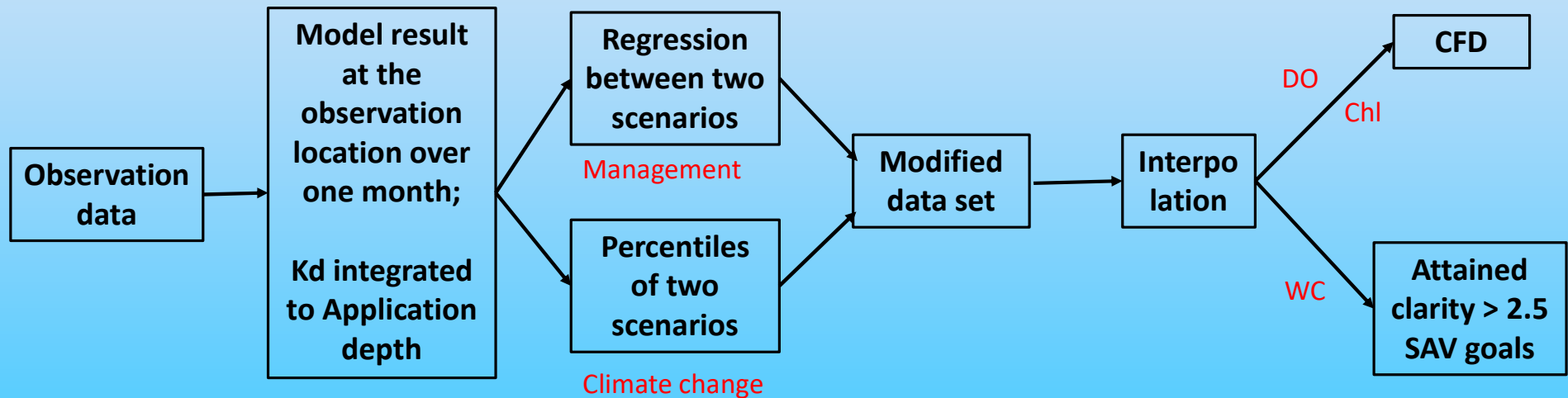
Salinity Regime	Water Clarity Criteria as Percent Light through Water	Water Clarity Criteria as Secchi Depth (meters)				Seasonal Application
		Water Clarity Criteria Application Depths (meters)				
		0.5	1.0	1.5	2.0	
		Secchi Depth Equivalents for Criteria Application Depth				
Tidal Fresh	13%	0.4	0.7	1.1	1.4	April 1 to October 1
Oligohaline	13%	0.4	0.7	1.1	1.4	April 1 to October 1
Mesohaline	22%	0.5	1.0	1.4	1.9	April 1 to October 1

¹Based on application of the formula $PLW = 100\exp(-K_dZ)$, the appropriate PLW criterion value and the selected application depth (Z) are inserted and the equation is solved for K_d. The generated K_d value is then converted to Secchi depth (in meters) using the conversion factor $K_d = 1.45/\text{Secchi depth}$.

Application depth in the TMDL

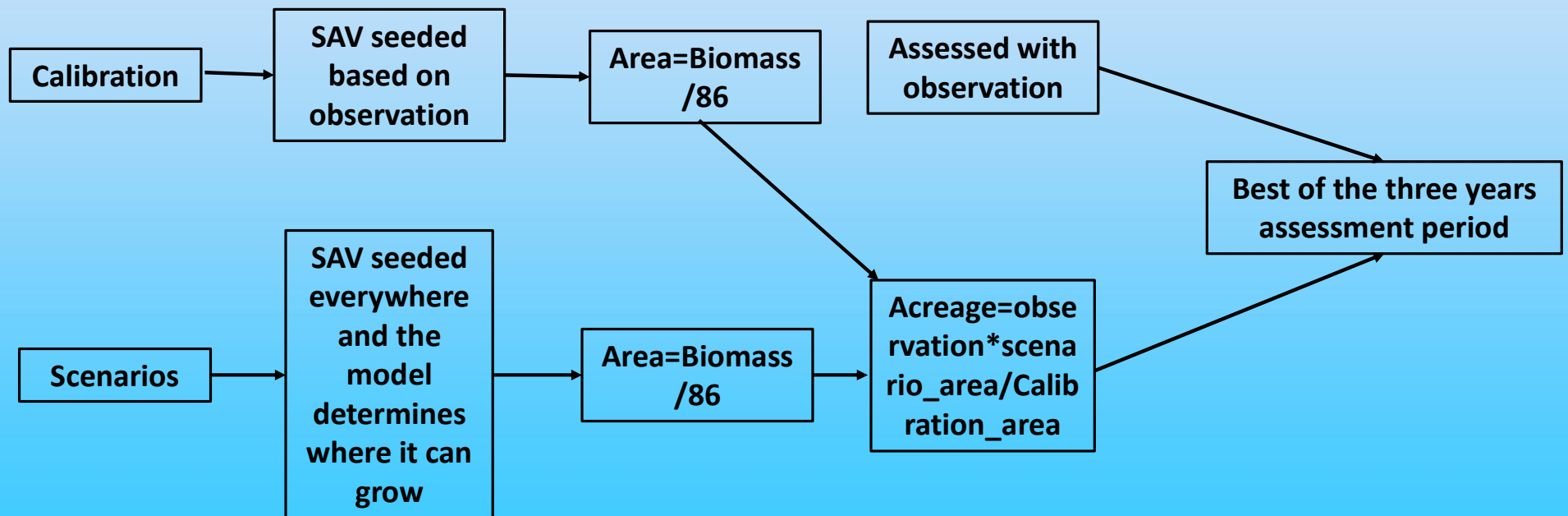
Segment Description ¹	Segment Designator	SAV Acreage Restoration Goal	Secchi Application Depth
Northern Chesapeake Bay	CB1TF2	12,149	2 meters
Northern Chesapeake Bay	CB1TF1	754	1.0 meters
Middle Pocomoke River Oligohaline	POCOH	22	0.5 meters
Lower Pocomoke River Mesohaline	POCMH	877 ²	1.0 meters
Manokin River Mesohaline	MANMH1	4,294	2.0 meters
Manokin River Mesohaline	MANMH2	59	0.5 meters
Big Annemessex River Mesohaline	BIGMH1	2,021	2.0 meters
Big Annemessex River Mesohaline	BIGMH2	22	0.5 meters
Tangier Sound Mesohaline	TANMH1	24,683 ²	2.0 meters
Tangier Sound Mesohaline	TANMH2	74	0.5 meters
Middle Nanticoke River Oligohaline	NANOH	12	0.5 meters
Lower Nanticoke River Mesohaline	NANMH	3	0.5 meters
Wicomico River Mesohaline	WICMH	3	0.5 meters
Fishing Bay Mesohaline	FSBMH	197	0.5 meters
Middle Choptank River Oligohaline	CHOOH	72	0.5 meters
Lower Choptank River Mesohaline	CHOMH2	1,621	1.0 meters
Mouth of Choptank River Mesohaline	CHOMH1	8,184	2.0 meters
Little Choptank River Mesohaline	LCHMH	4,076	2.0 meters
Honga River Mesohaline	HNGMH	7,761	2.0 meters
Eastern Bay	EASMH	6,209	2.0 meters
Upper Chester River Tidal Fresh	CSHTF	230	0.5 meters
Middle Chester River Oligohaline	CHSOH	77	0.5 meters
Lower Chester River Mesohaline	CHSMH	2,928	1.0 meters
Chesapeake & Delaware (C&D) Canal	C&DOH	7	0.5 meters
Northeast River Tidal Fresh	NORTF	89	0.5 meters
Bohemia River Oligohaline	BOHOH	354	0.5 meters
Elk River Oligohaline	ELKOH1	1,844	2.0 meters
Elk River Oligohaline	ELKOH2	190	0.5 meters
Sassafras River Oligohaline	SASOH1	1,073	2.0 meters
Sassafras River Oligohaline	SASOH2	95	0.5 meters
Bush River Oligohaline	BSHOH	350	0.5 meters
Gunpowder River Oligohaline	GUNOH2	572	2.0 meters
Mouth of Gunpowder River	GUNOH1	1,860	0.5 meters
Middle River Oligohaline	MIDOH	879	2.0 meters
Back River Oligohaline	BACOH	340	0.5 meters
Patapsco River Mesohaline	PATMH	389	1.0 meters
Magothy River Mesohaline	MAGMH	579	1.0 meters

DO, Chlorophyll and Water clarity (WC) assessment methods for model scenarios



SAV assessment methods for model scenarios

During the July period of annual, baywide, maximum SAV biomass, SAV beds in the Chesapeake Bay typically averaged approximately 0.86 metric tons of aboveground dry mass per hectare of bed area. Moore et al., 2000



Combination of water clarity (WC) and SAV

Combined acreage = WC_acreage + 1.5 SAV_acreage

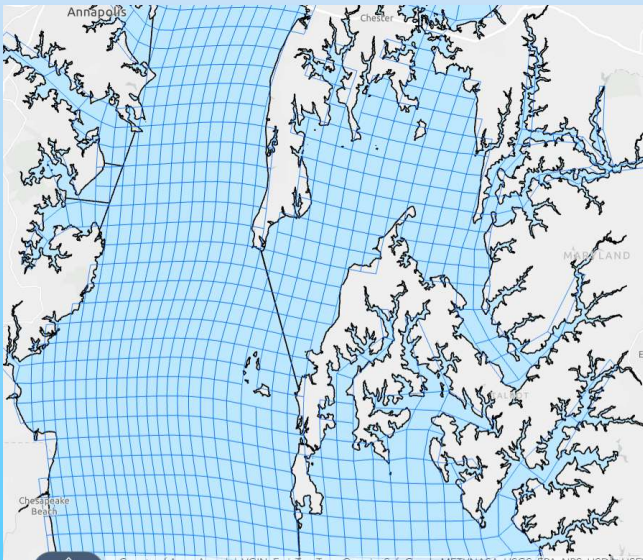
Combined acreage = WC_acreage + 2.5 SAV acreage

Current model deep channel assessment (14v)

Scenario	name	Cal	NoAction_P6	NoAction_P7	WIP_P6	WIP_P7	E3_P6	E3_P7	AllForest_P6	AllForest_P7
Run	name	RUN14v	2010NOACTA A_20171001	RUN14vNoac t_spin6	2010WIP2_20 171001	RUN14vWIP_ spin6	2010E3AA_20 171001	RUN14vE3_s pin6	2010ALLFOR_ 20171001	RUN14vALLF_ spin6
Nitrogen	loading	325	404	404	195	195	133	133	40	40
Phosphorous	loading	21.9	41.7	41.7	13.7	13.7	8.6	8.6	3.9	3.9
Start	End	1993_1995	1993_1995	1993_1995	1993_1995	1993_1995	1993_1995	1993_1995	1993_1995	1993_1995
Cbseg	State	DO_I_DC	DO_I_DC	DO_I_DC	DO_I_DC	DO_I_DC	DO_I_DC	DO_I_DC	DO_I_DC	DO_I_DC
CB3MH	MD	7.22%	12.65%	9.23%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CB4MH	MD	45.61%	52.96%	48.26%	5.87%	10.01%	0.00%	0.00%	0.00%	0.00%
CB5MH_MD	MD	24.08%	26.51%	24.18%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CB5MH_VA	VA	3.75%	10.33%	3.35%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
POTMH_MD	MD	19.10%	21.25%	21.27%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
RPPMH	VA	14.21%	25.41%	9.96%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CHSMH	MD	16.92%	25.97%	19.28%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
EASMH	MD	18.26%	27.28%	20.18%	6.24%	0.61%	0.00%	0.00%	0.00%	0.00%
PATMH	MD	22.41%	40.34%	35.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

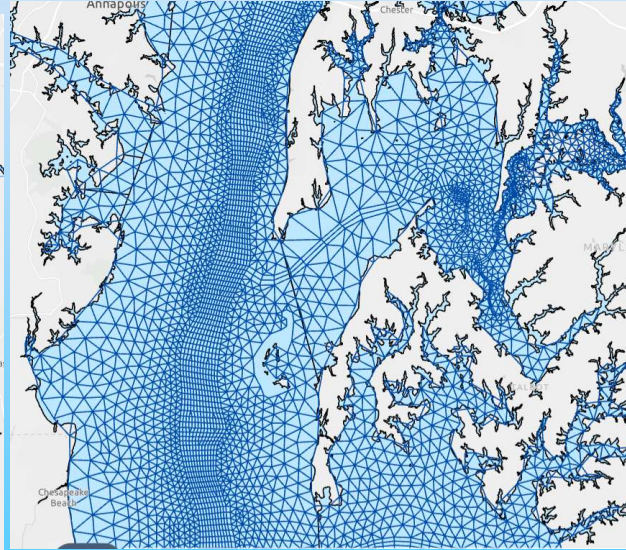
Difference in simulation grid and bathymetry

CH3D grid



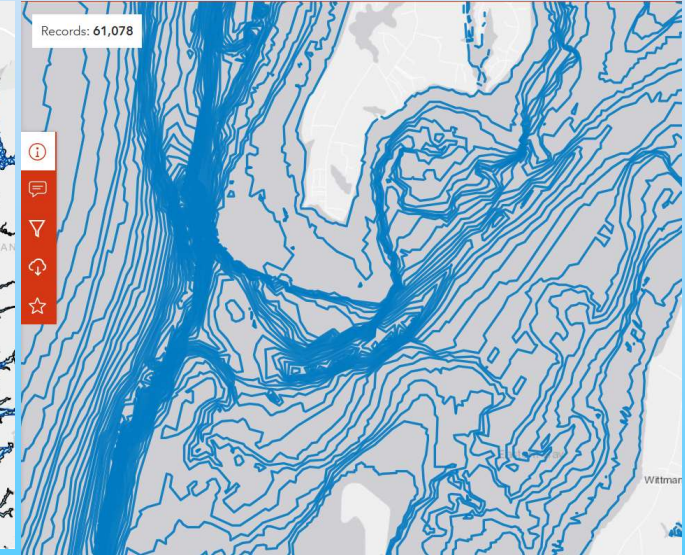
29 m

Schism grid



41 m

Bathymetry



41 m

<https://gis.chesapeakebay.net/modeling/>

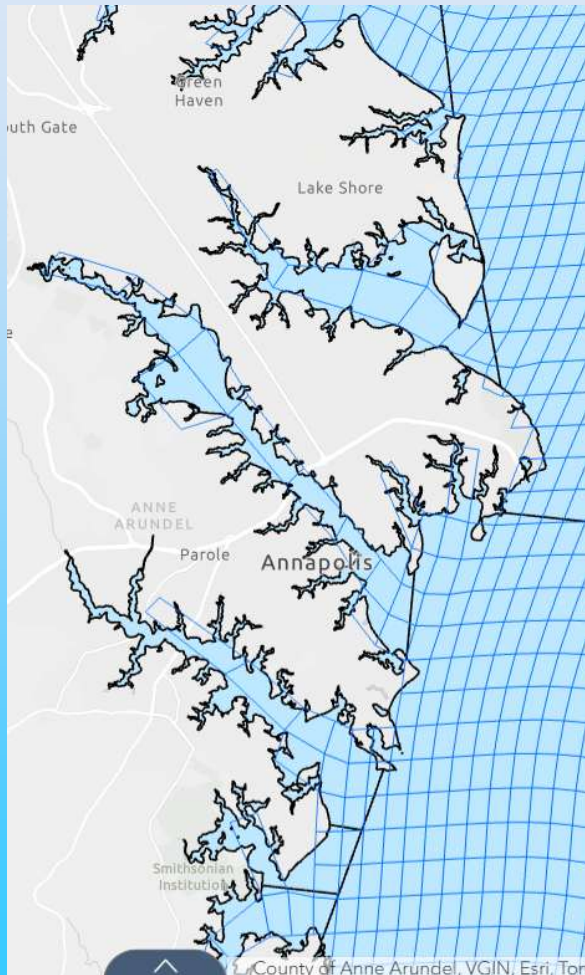
Slide from Lewis Linker

Current model deep water assessment (14v)

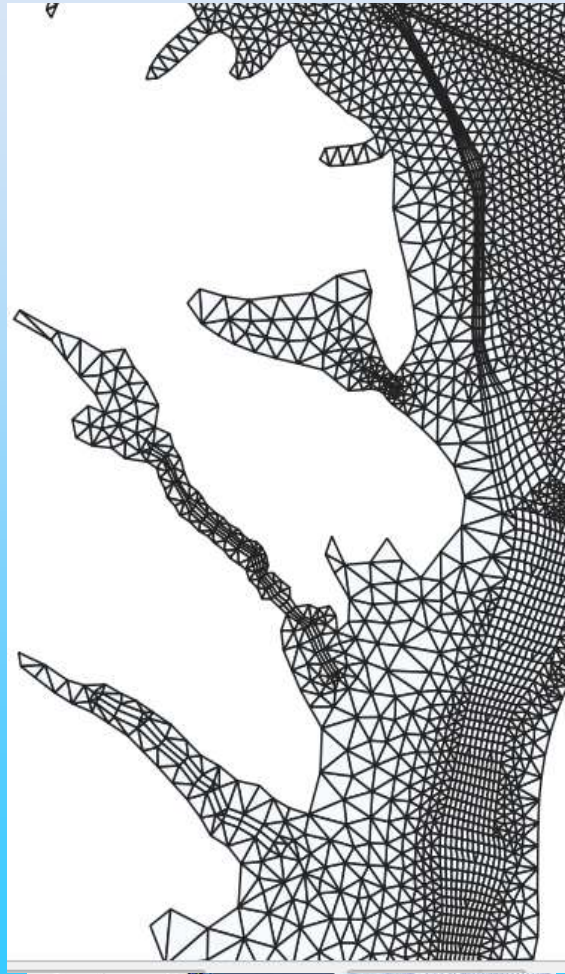
Scenario	name	Cal	NoAction_P6	NoAction_P7	WIP_P6	WIP_P7	E3_P6	E3_P7	AllForest_P6	AllForest_P7
Run	name	RUN14v	2010NOACTA A_20171001	RUN14vNoac t_spin6	2010WIP2_2 0171001	RUN14vWIP_ spin6	2010E3AA_2 0171001	RUN14vE3_s pin6	2010ALLFOR _20171001	RUN14vAIIF_ spin6
Nitrogen	loading	325	404	404	195	195	133	133	40	40
Phosphorous	loading	21.9	41.7	41.7	13.7	13.7	8.6	8.6	3.9	3.9
Start	End	1993_1995	1993_1995	1993_1995	1993_1995	1993_1995	1993_1995	1993_1995	1993_1995	1993_1995
Chseg	State	DO_M_DW	DO_M_DW	DO_M_DW	DO_M_DW	DO_M_DW	DO_M_DW	DO_M_DW	DO_M_DW	DO_M_DW
CB3MH	MD	2.41%	2.69%	3.24%	0.05%	0.40%	0.00%	0.00%	0.00%	0.00%
CB4MH	MD	23.99%	25.19%	27.45%	5.00%	5.66%	1.09%	0.03%	0.00%	0.00%
CB5MH_MD	MD	10.73%	9.30%	11.83%	0.94%	0.24%	0.00%	0.00%	0.00%	0.00%
CB5MH_VA	VA	0.66%	0.66%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CB6PH	VA	1.70%	0.39%	1.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CB7PH	VA	0.19%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
PATMH	MD	9.00%	17.35%	21.61%	0.67%	0.20%	0.00%	0.00%	0.00%	0.00%
MAGMH	MD	55.63%	56.14%	44.52%	1.21%	45.51%	0.34%	6.77%	0.00%	0.00%
SOU MH	MD	23.68%	27.97%	25.55%	2.96%	19.97%	0.00%	13.43%	0.00%	0.00%
SEVMH	MD	8.03%	7.79%	8.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
PAXMH	MD	12.95%	17.09%	19.18%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
POTMH_MD	MD	8.41%	7.07%	10.84%	0.00%	0.16%	0.00%	0.00%	0.00%	0.00%
RPPMH	VA	13.38%	10.73%	12.59%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
YRKPH	VA	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
SBEMH	VA	0.77%	3.47%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CHSMH	MD	6.14%	11.31%	10.41%	0.00%	0.97%	0.00%	0.00%	0.00%	0.00%
EASMH	MD	3.35%	25.44%	6.91%	0.45%	0.02%	0.35%	0.00%	0.00%	0.00%

Grids and bathymetry of Magathy, Severn and South Rivers

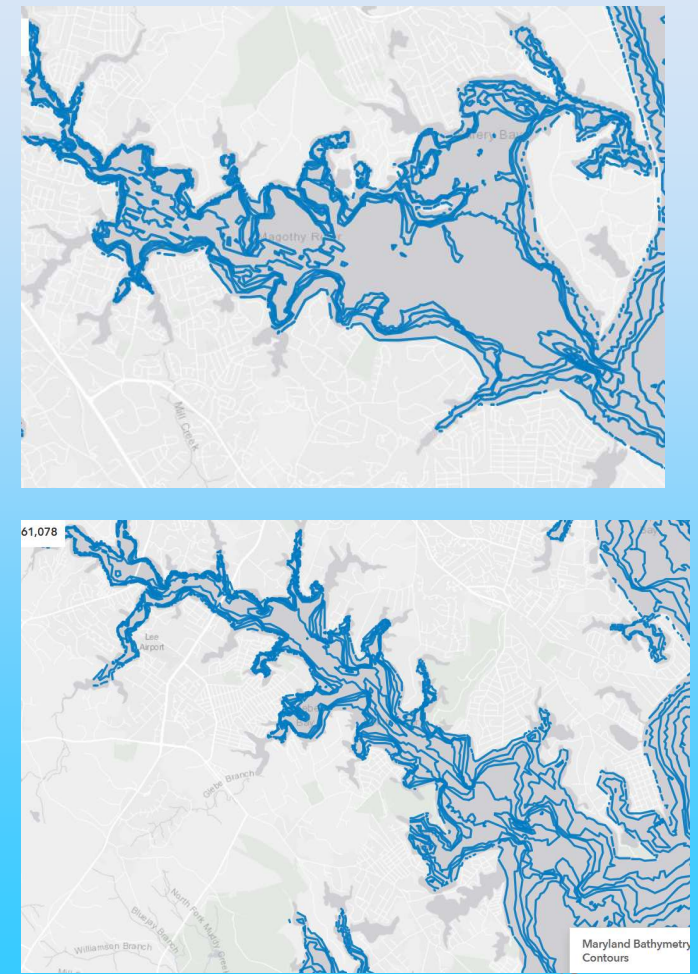
CH3D grid



Schism grid



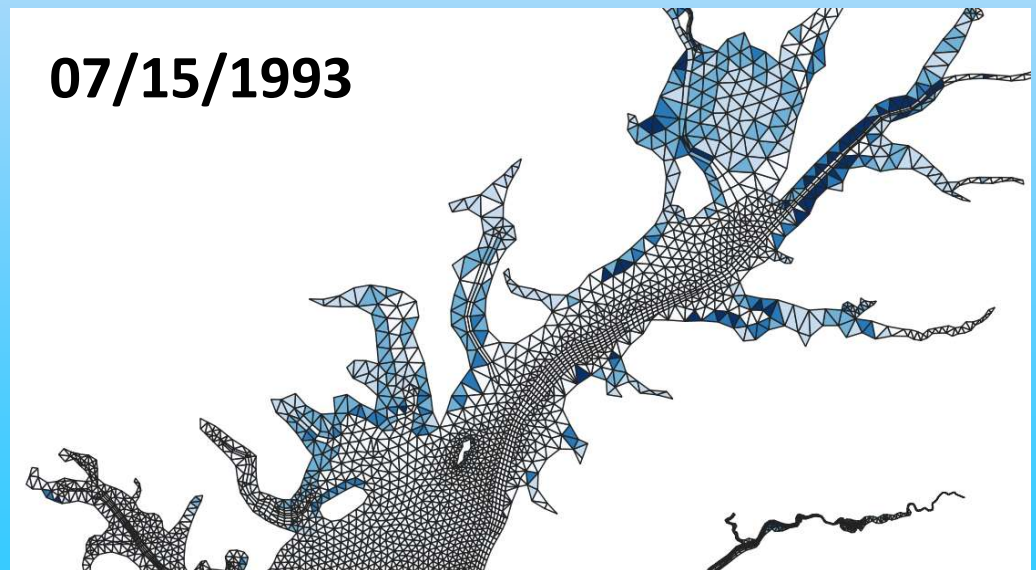
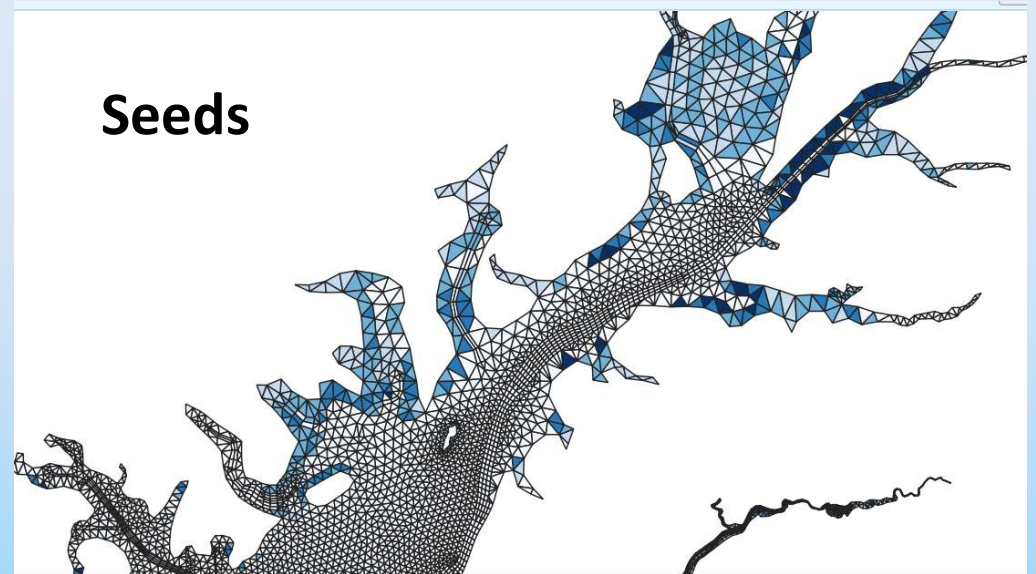
Bathymetry



Current model open water assessment (14v)

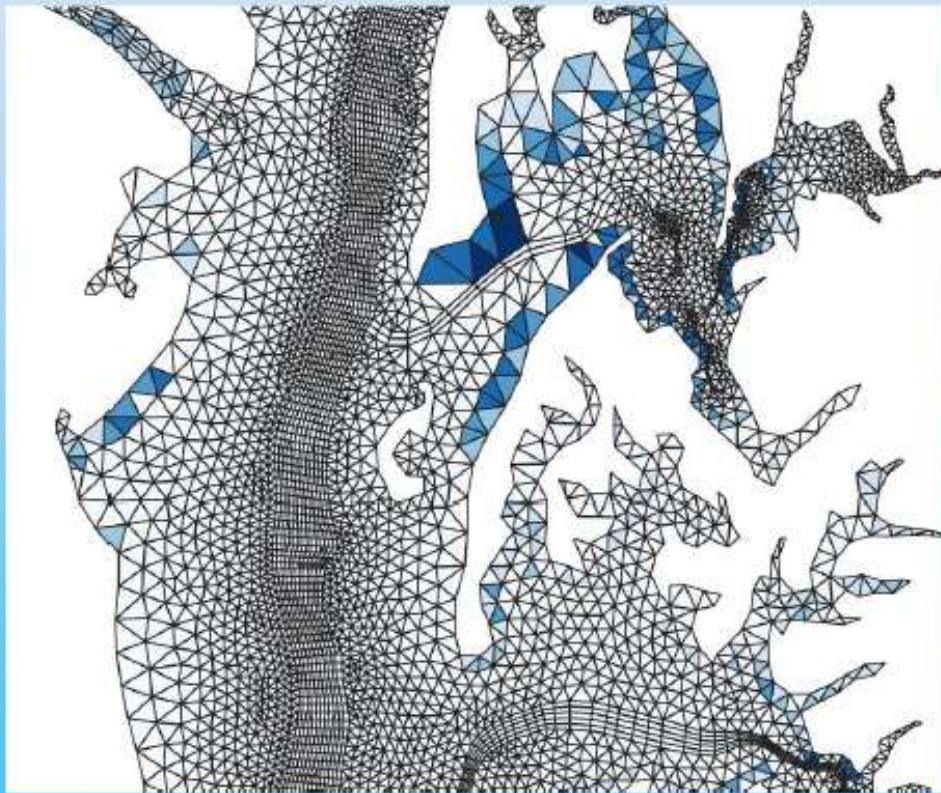
Scenario	name	Cal	NoAction_P6	NoAction_P7	WIP_P6	WIP_P7	E3_P6	E3_P7	AllForest_P6	AllForest_P7	WIP_P7_4mg/l
Run	name	RUN14v	2010NOACTA A_20171001	RUN14vNoac t_spin6	2010WIP2_2 0171001	RUN14vWIP_ spin6	2010E3AA_2 0171001	RUN14vE3_s pin6	2010ALLFOR _20171001	RUN14vALLF_ spin6	RUN14vWIP_spi n6
Nitrogen	loading	325	404	404	195	195	133	133	40	40	195
Phosphorous	loading	21.9	41.7	41.7	13.7	13.7	8.6	8.6	3.9	3.9	13.7
Start	End	1993_1995	1993_1995	1993_1995	1993_1995	1993_1995	1993_1995	1993_1995	1993_1995	1993_1995	1993_1995
Cbseg	State	DO_M_Ows	DO_M_Ows	DO_M_Ows	DO_M_Ows	DO_M_Ows	DO_M_Ows	DO_M_Ows	DO_M_Ows	DO_M_Ows	DO_M_Ows
GUNOH	MD	4.59%	4.59%	4.59%	4.59%	4.59%	0.00%	0.00%	0.00%	0.00%	0.00%
PAXTF	MD	9.11%	9.44%	9.21%	7.77%	7.04%	0.00%	0.00%	0.00%	0.00%	0.00%
WBRTF	MD	4.59%	4.59%	4.59%	4.59%	4.59%	0.00%	4.59%	17.88%	0.00%	0.00%
PAXOH	MD	20.70%	33.05%	20.64%	0.00%	7.05%	0.00%	1.49%	0.00%	0.00%	0.00%
PAXMH	MD	2.15%	8.84%	4.87%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
PISTF	MD	4.42%	4.63%	4.54%	0.77%	4.40%	0.00%	3.02%	0.00%	0.00%	0.00%
CRRMH	VA	24.53%	26.41%	21.16%	5.21%	0.12%	1.76%	0.00%	0.00%	0.00%	0.00%
PMKTF	VA	11.01%	15.64%	11.01%	8.62%	3.14%	4.59%	0.00%	0.00%	0.00%	3.14%
PMKOH	VA	1.08%	7.36%	2.40%	0.52%	0.00%	0.00%	0.00%	0.12%	0.00%	0.00%
YRKMH	VA	24.53%	30.58%	25.75%	0.77%	5.03%	0.00%	0.08%	0.00%	0.00%	0.00%
WBEMH	VA	15.29%	15.29%	7.80%	7.80%	1.04%	3.29%	0.00%	0.00%	0.00%	0.00%
SASOH	MD	9.23%	29.45%	10.78%	0.56%	0.78%	0.00%	0.00%	0.00%	0.00%	0.00%
CHOTF	MD	0.00%	8.49%	11.50%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CHOOH	MD	0.45%	10.38%	5.73%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CHOMH2	MD	4.36%	12.79%	7.48%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CHOMH1	MD	1.75%	2.83%	2.18%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
WICMH	MD	11.22%	11.21%	11.49%	4.96%	11.09%	4.65%	7.29%	0.65%	0.00%	0.00%

**Seeded cells got SAV
growth**

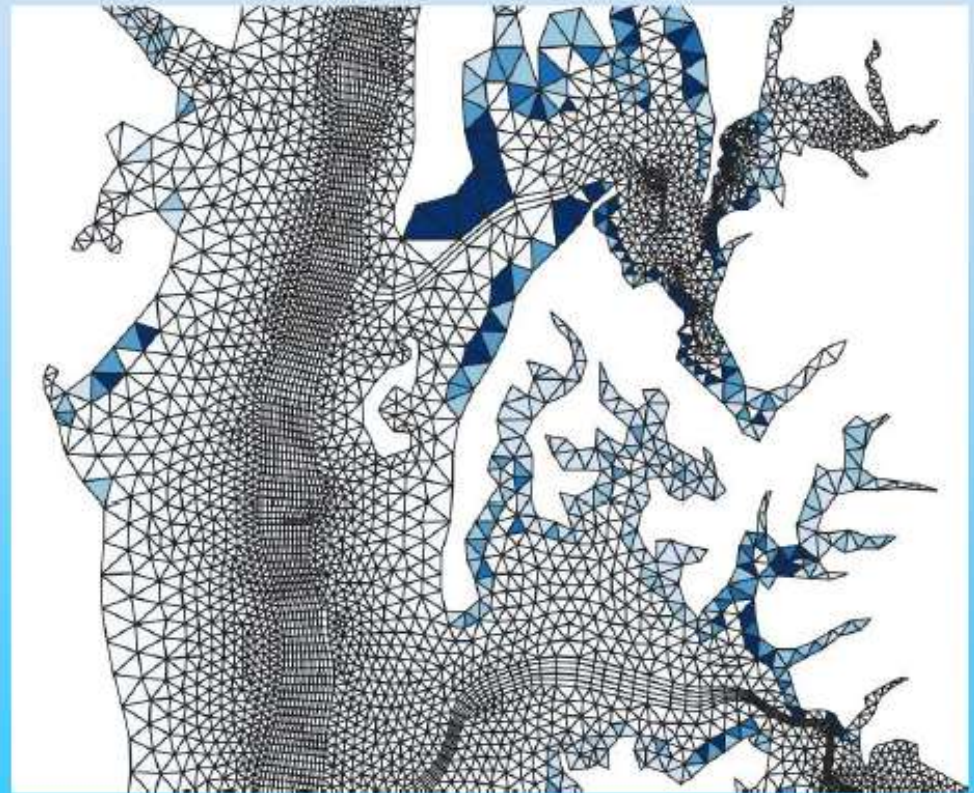


Simulated SAV in Eastern Bay and Choptank

Calibration(July 15, 1993)



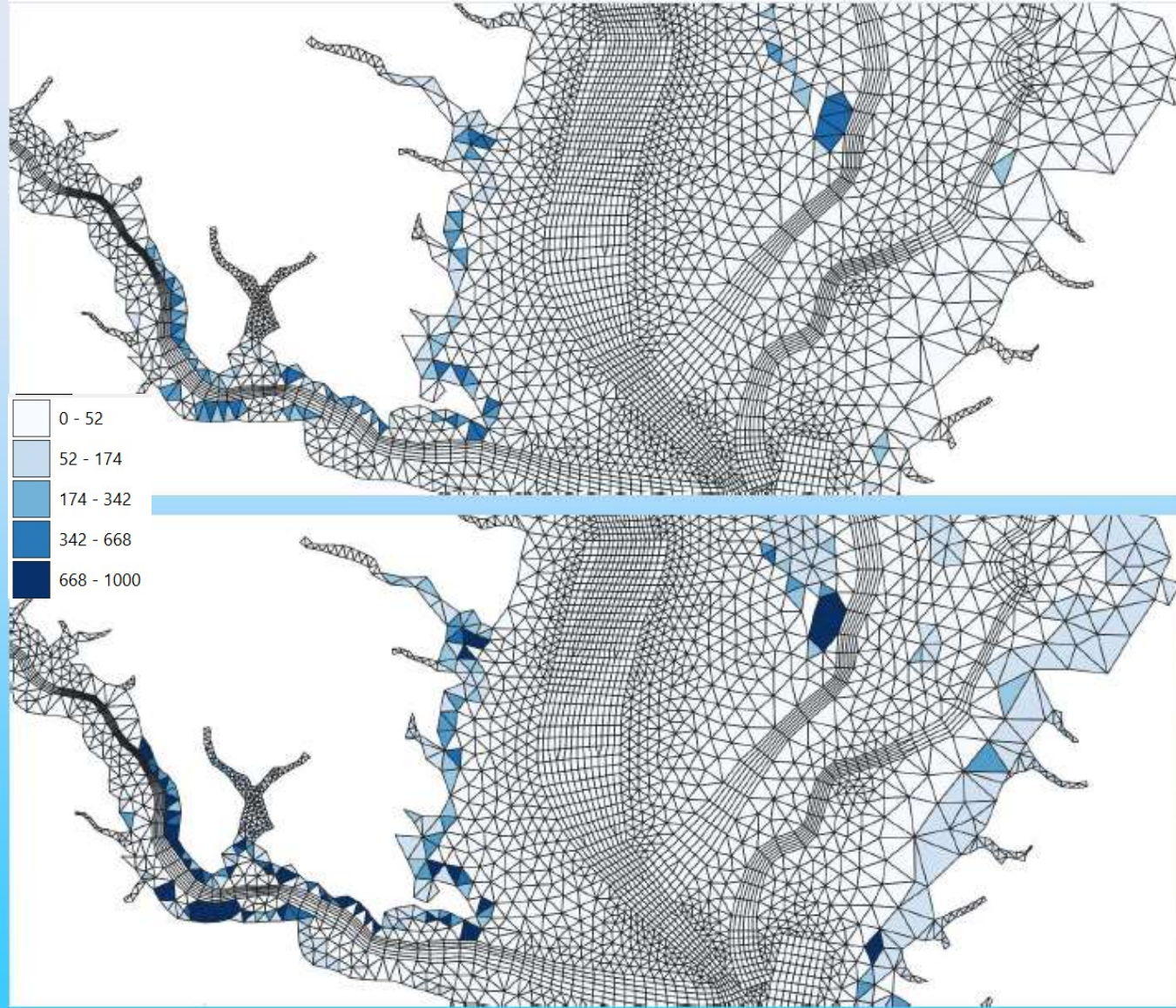
WIP (july 15, 1993)



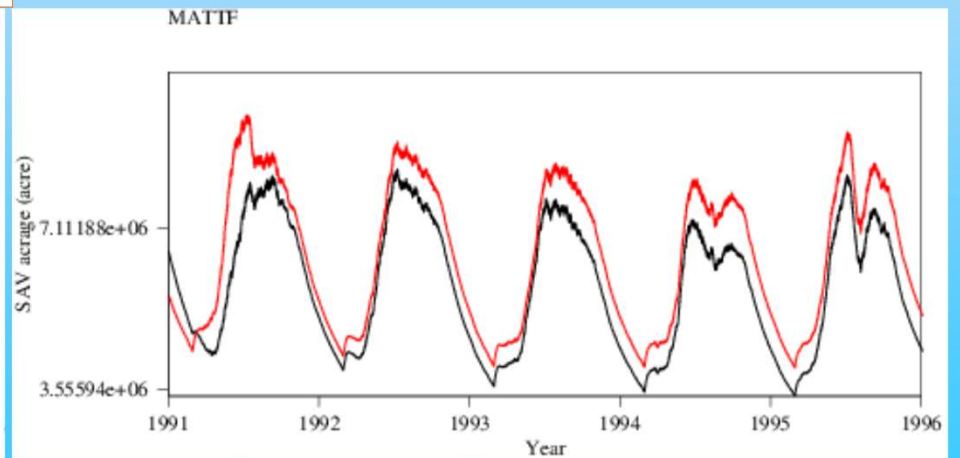
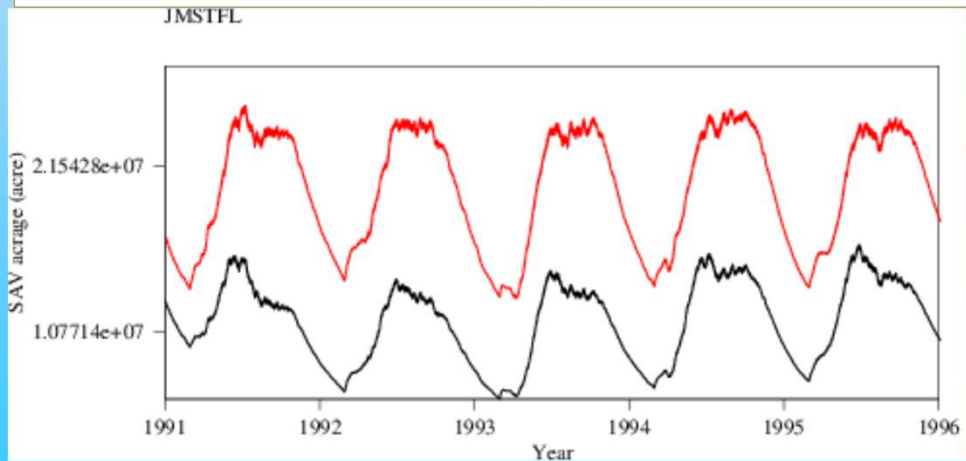
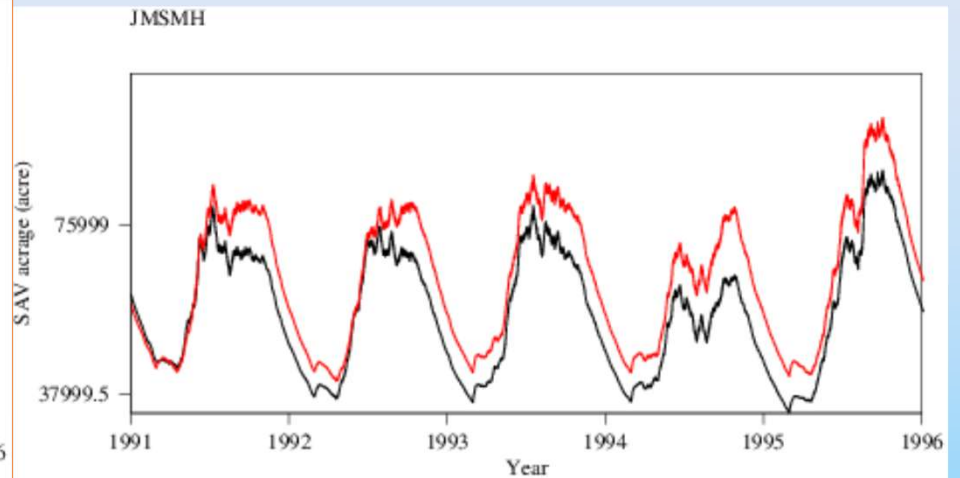
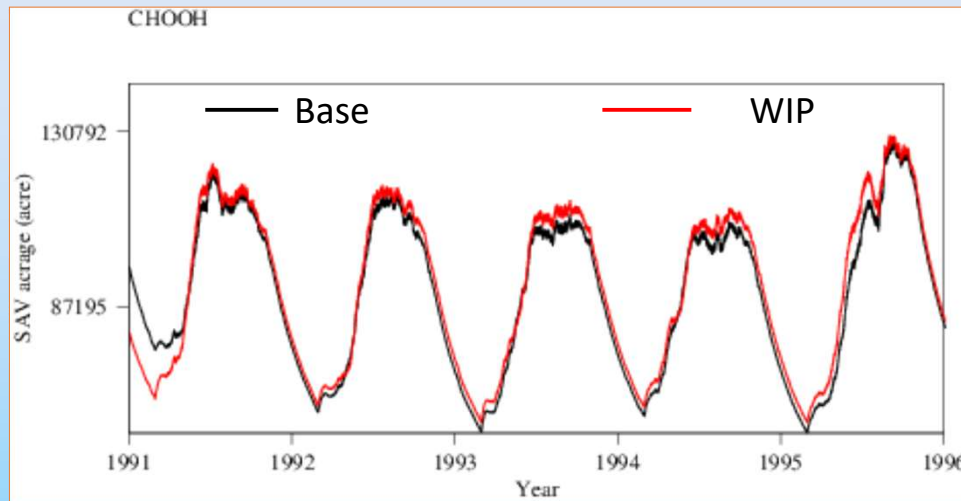
Simulated SAV in Rappahannock, and VA Eastern Shore

Calibration(July 15, 1993)

WIP3 (july 15, 1993)

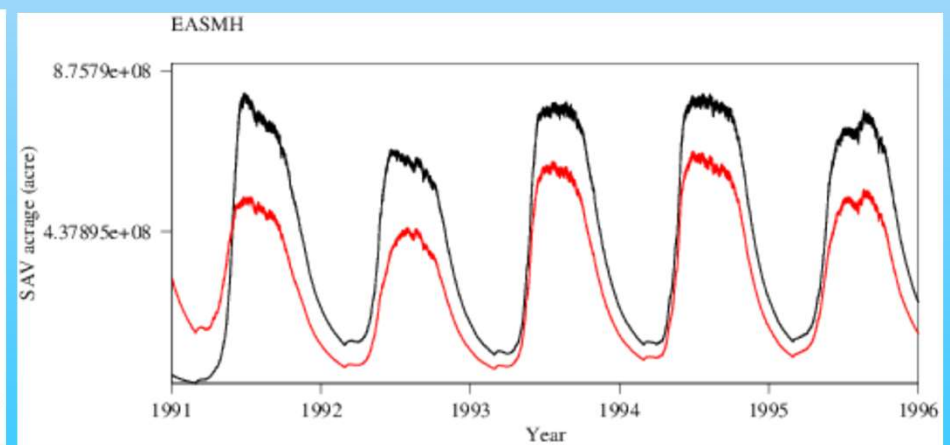
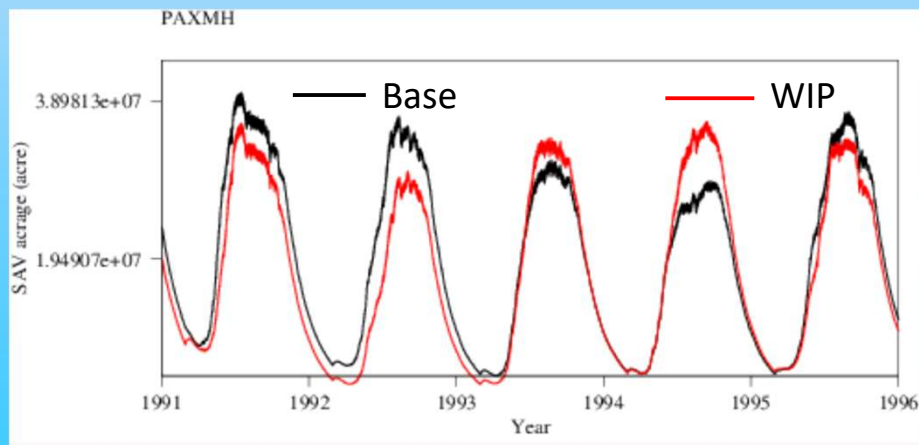
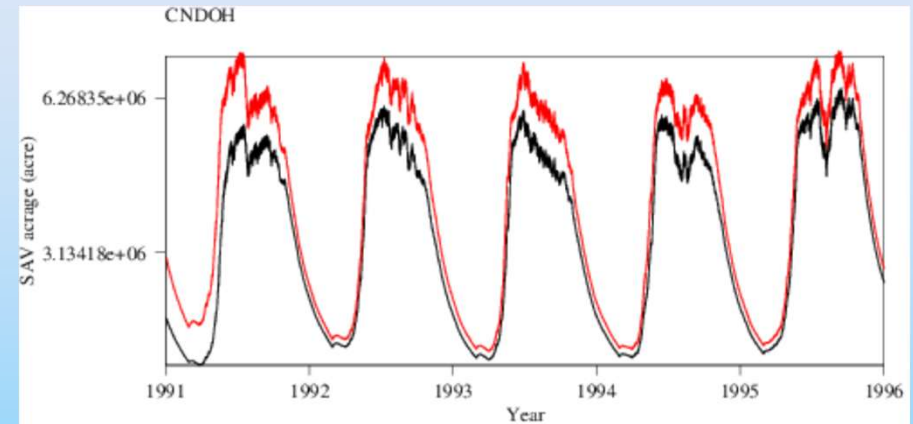
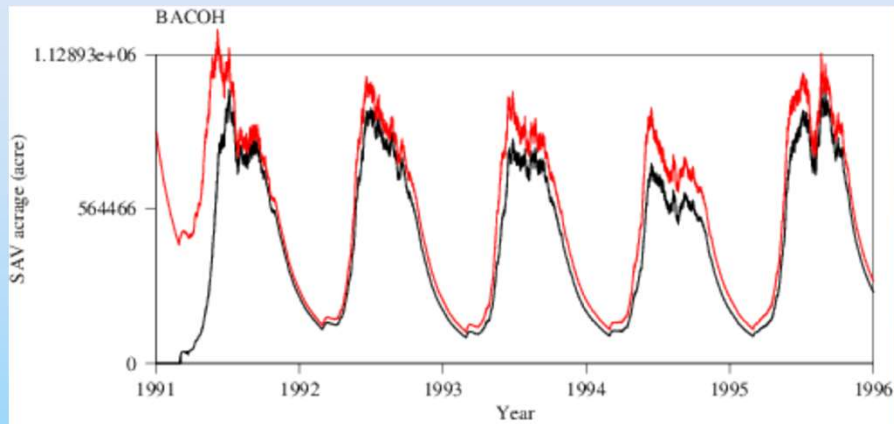


Examples of SAV acreage, WIP3 (red) versus Base (black)



RUN14v and RUN14vwp initial parameter values

Examples of SAV acreage, WIP3 (red) versus Base (black)



SAV/water clarity (WC) assessment

Number of segments attained

	Calibration (observation)	WIP3 (regression)	WIP3 (percentile)
Water clarity	2	10	7
SAV	2	39	39
WC+1.5SAV	2	44	44
WC+2.5SAV	2	48	48

The total numbers of attained segments are the same between regression and percentile methods but attained segments may differ

SAV/water clarity (WC) assessment map

