

4D output visualization discussion/ideas

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Visualization ideas: By segment

*What would
be helpful?*

Examining detailed 4D results

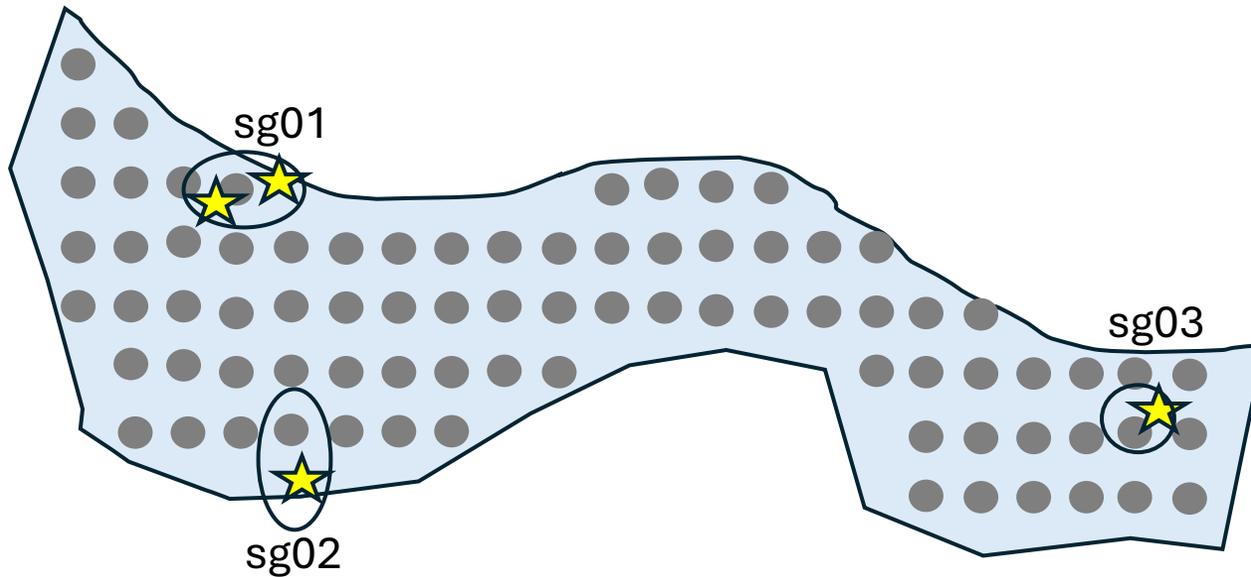
- Map of: grid, stations, and matching station to grid points for plotting.
- Time series of observed DO and nearby simulation results at multiple depths.
- Map of interpolator grid cells with ability to see fraction of interpolation results $<$ DO thresholds by DUs or layers. For example:
 - Fraction of DW cells $<$ 3 mg/L, or
 - Fraction of bottom cells $<$ 1 mg/L
- Seasonal time series of fraction $<$ DO thresholds across entire segment.

Overall measures

- Summary statistics by segment, season, and DUs, for example:
 - Mean DO,
 - Fraction $<$ DO thresholds.
→ Could compare to just data, 3D results, year-to-year.
- Summary graphics:
Empirical density functions, histograms.

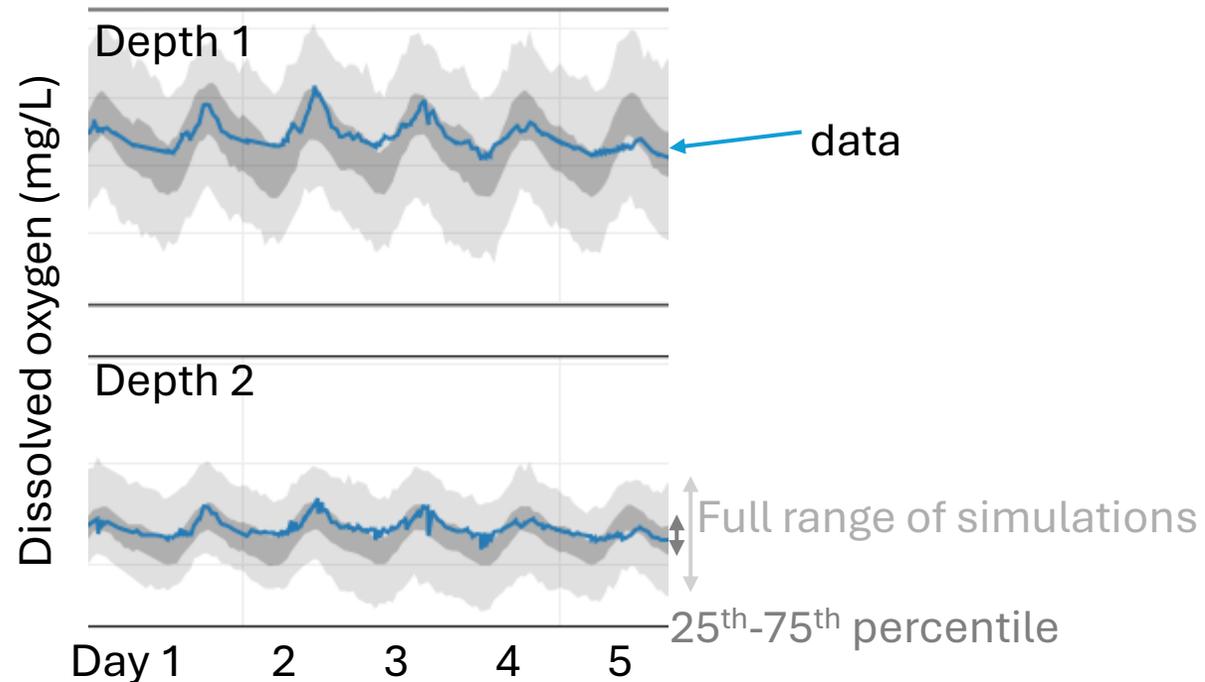
Visualization ideas: Map

- Map of grid, stations, and matching station to grid points for plotting



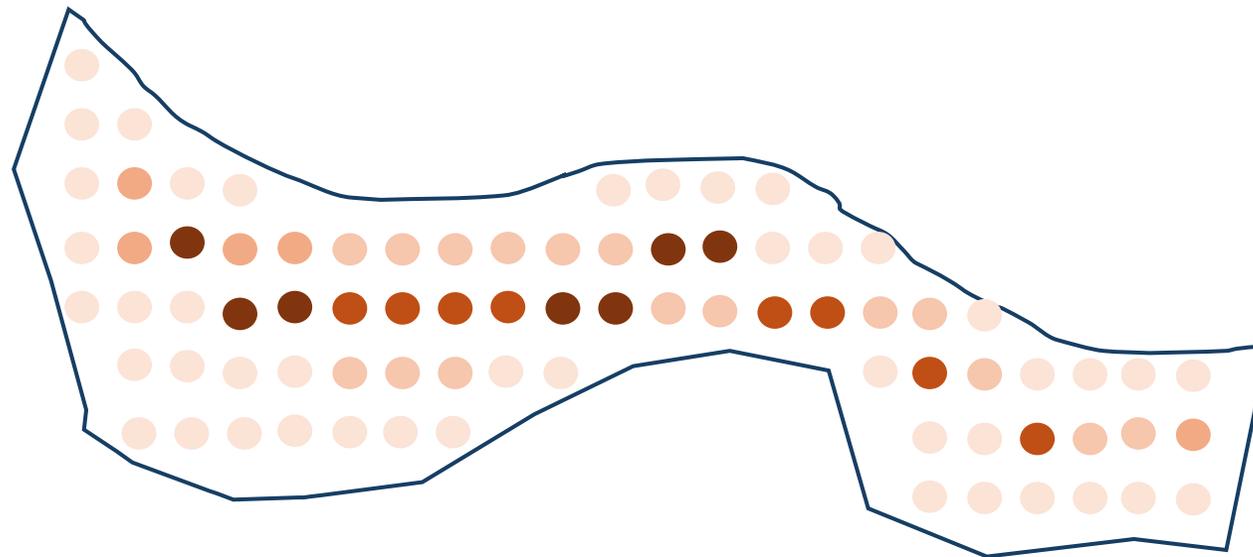
Visualization ideas: Time series

- Time series of observed DO and nearby simulation results at multiple depths. This will show the range of simulation values and how they compare to the data.



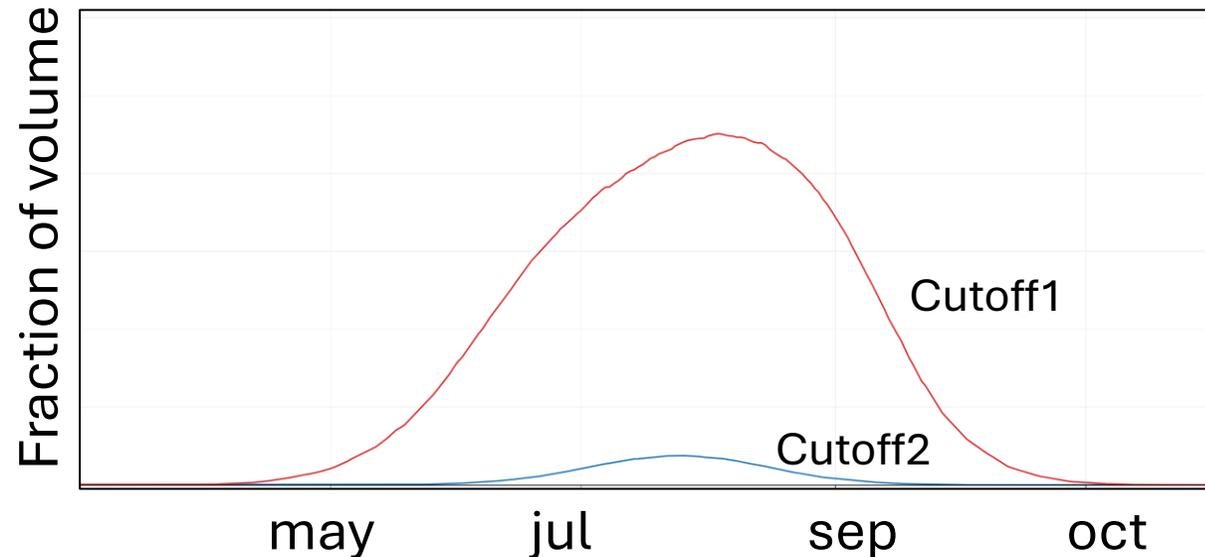
Visualization ideas: Threshold maps

- Map of interpolator grid cells with ability to see fraction of interpolation results $<$ DO thresholds. This can be for layers of the water column and/or specific designated uses. For example:
 - Fraction of DW cells $<$ 3 mg/L, or
 - Fraction of bottom cells $<$ 1mg/L.



Visualization ideas: Threshold over the season

- Seasonal time series of fraction $<$ DO thresholds across entire segment. For example:
 - Fraction of DW cells $<$ 3 mg/L, or
 - Fraction of bottom cells $<$ 1mg/L.



Visualization ideas: Aggregated values

- Overall summaries: useful for a quick view comparing year-to-year and to data.

In one segment, possibly by DU:

	4D 2022	Data 2022	4D 2023	Data 2023
Mean				
Fraction with DO < 1.0 mg/L				
Fraction with DO < 3.2 mg/L				
Fraction with DO < 5.0 mg/L				

Ideas?

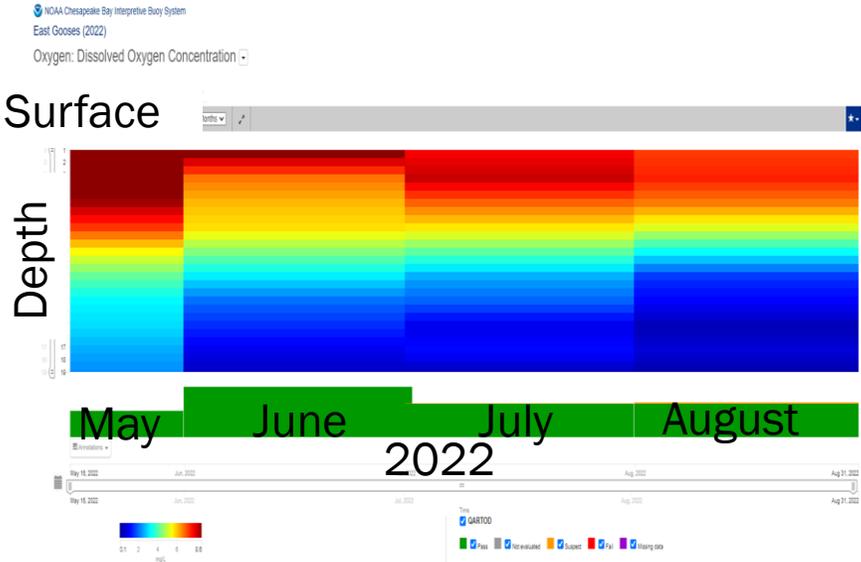
Extra slides

Table 1. Chesapeake Bay dissolved oxygen criteria.

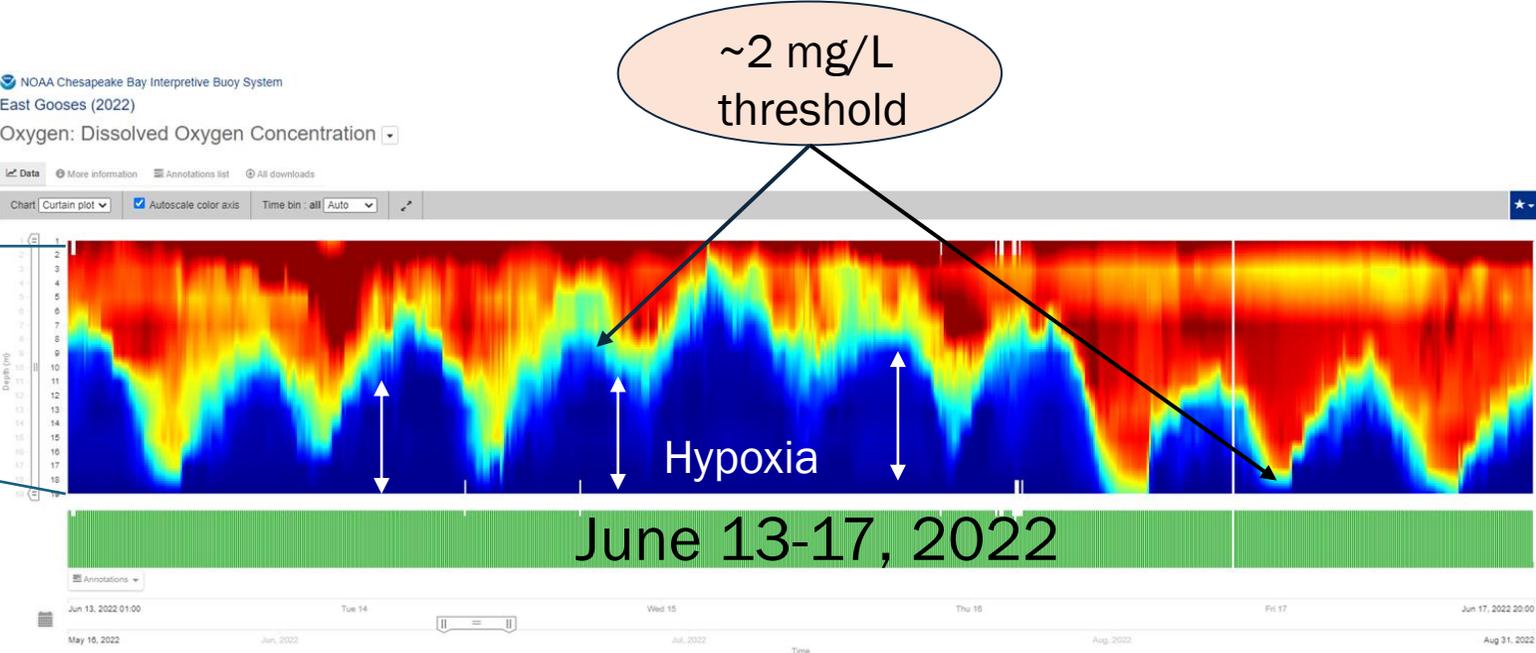
Designated Use	Criteria Concentration/Duration	Protection Provided	Temporal Application
Migratory fish spawning and nursery use	7-day mean ≥ 6 mg liter ⁻¹ (tidal habitats with 0-0.5 ppt salinity)	Survival/growth of larval/juvenile tidal-fresh resident fish; protective of threatened/endangered species.	February 1 - May 31
	Instantaneous minimum ≥ 5 mg liter ⁻¹	Survival and growth of larval/juvenile migratory fish; protective of threatened/endangered species.	
	* Open-water fish and shellfish designated use criteria apply		
Shallow-water bay grass use	Open-water fish and shellfish designated use criteria apply		Year-round
Open-water fish and shellfish use	30-day mean ≥ 5.5 mg liter ⁻¹ (tidal habitats with 0-0.5 ppt salinity)	Growth of tidal-fresh juvenile and adult fish; protective of threatened/endangered species.	Year-round
	30-day mean ≥ 5 mg liter ⁻¹ (tidal habitats with >0.5 ppt salinity)	Growth of larval, juvenile and adult fish and shellfish; protective of threatened/endangered species.	
	7-day mean ≥ 4 mg liter ⁻¹	Survival of open-water fish larvae.	
	Instantaneous minimum ≥ 3.2 mg liter ⁻¹	Survival of threatened/endangered sturgeon species. ¹	
Deep-water seasonal fish and shellfish use	30-day mean ≥ 3 mg liter ⁻¹	Survival and recruitment of bay anchovy eggs and larvae.	June 1 - September 30
	1-day mean ≥ 2.3 mg liter ⁻¹	Survival of open-water juvenile and adult fish.	
	Instantaneous minimum ≥ 1.7 mg liter ⁻¹	Survival of bay anchovy eggs and larvae.	
	Open-water fish and shellfish designated-use criteria apply		
Deep-channel seasonal refuge use	Instantaneous minimum ≥ 1 mg liter ⁻¹	Survival of bottom-dwelling worms and clams.	June 1 - September 30
	Open-water fish and shellfish designated use criteria apply		October 1 - May 31

¹ At temperatures considered stressful to shortnose sturgeon (>29°C), dissolved oxygen concentrations above an instantaneous minimum of 4.3 mg liter⁻¹ will protect survival of this listed sturgeon species.

What's the difference between the 3D and 4D Interpolators? *Data Inputs as an Analogy*



Traditional Bay monitoring
3.5 months
1x per month water
column
data collection



Continuous dissolved oxygen 5 days,
10-minute data collection intervals