GIT-Funded Open Bay Hypoxia Assessment with New Technologies - Pilot Project. A first look at 2020 results

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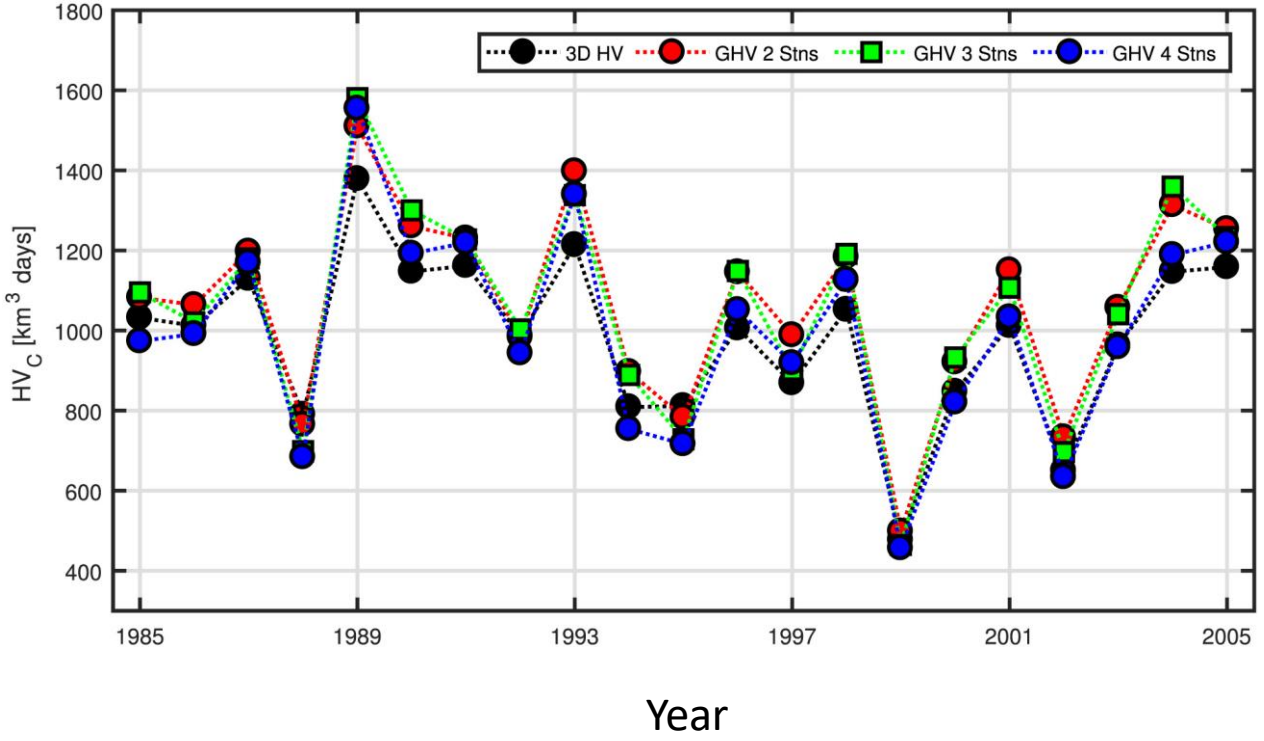
Modeling WG
9/10/2020

Inspiration on monitoring strategy alternatives: Estimating annual hypoxic volume for Chesapeake Bay with as few as 2 realtime vertical profile stations in the open Bay.



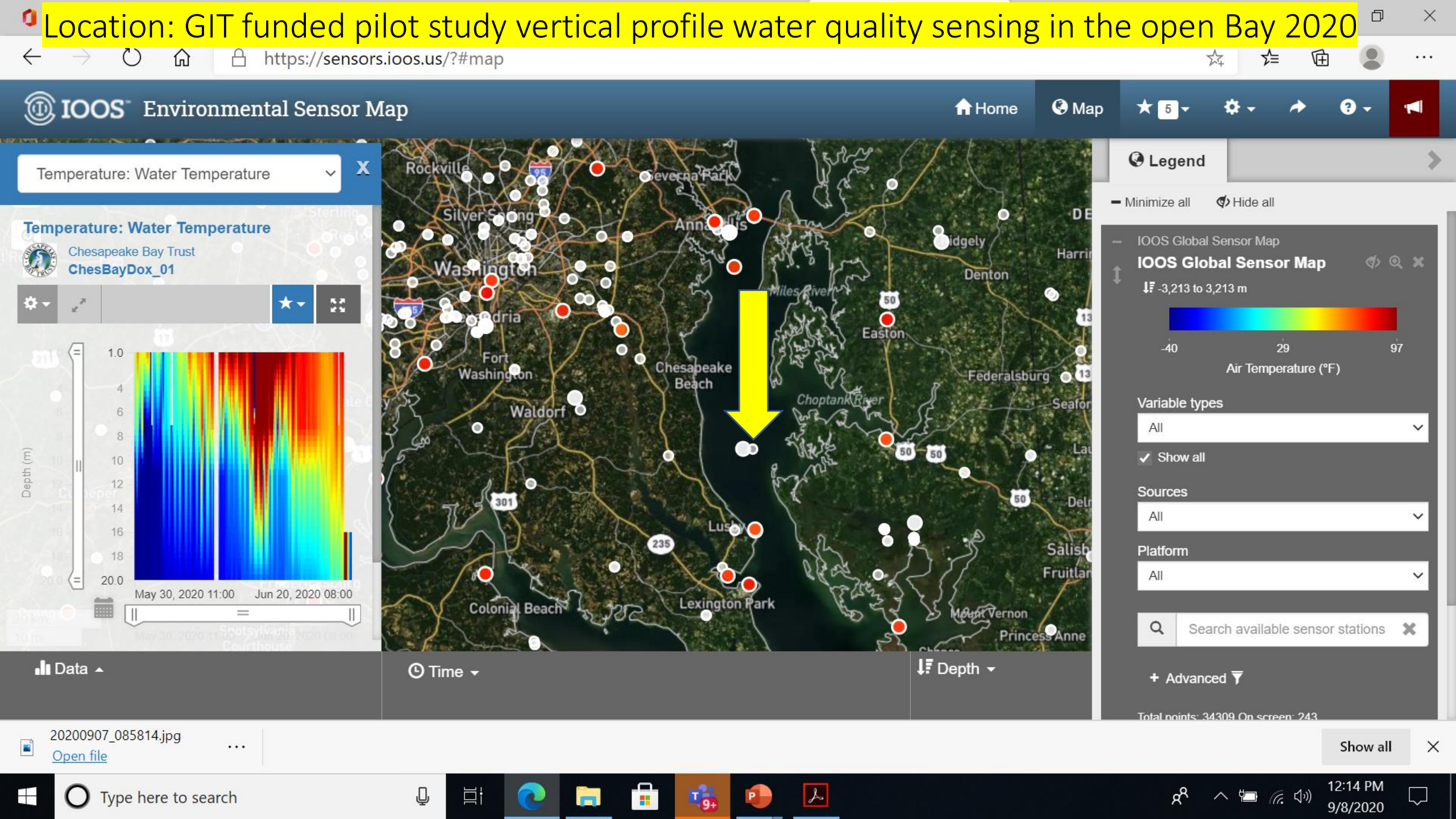
3DHV=Model absolute hypoxic volume
GHV2 = estimate from 2 stations
GHV3 = estimate from 3 stations
GHV4 = estimate from 4 stations

Bever, A. J., Friedrichs, M. A. M., Friedrichs, C. T., Scully, M. E., & Lanerolle, L. W. J. 2013. Combining observations and numerical model results to improve estimates of hypoxic volume within the Chesapeake Bay, USA. *Journal of Geophysical Research: Oceans*, **118**, 4924– 4944.

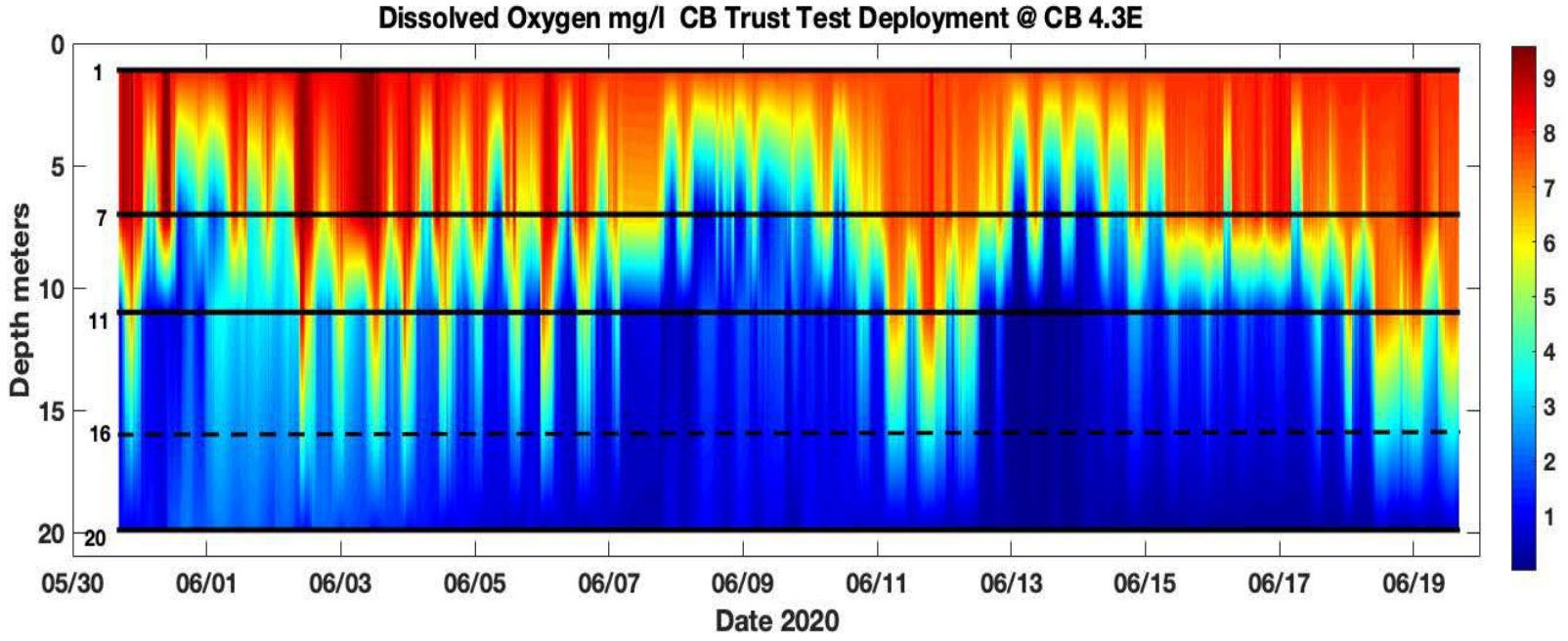
Bever et al. 2018. Estimating Hypoxic Volume in the Chesapeake Bay Using Two Continuously Sampled Oxygen Profiles. JGR Oceans https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2018JC014129

2020 GIT Project Goal:
Proof of concept in testing a portable, easily deployable, modest price sensor array for open bay, realtime water quality data collection.

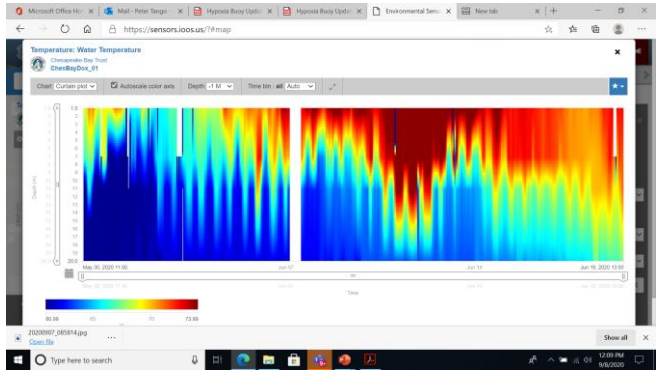
Location: GIT funded pilot study vertical profile water quality sensing in the open Bay 2020



GIT funded Pilot study vertical profile water quality sensing in the open Bay 2020



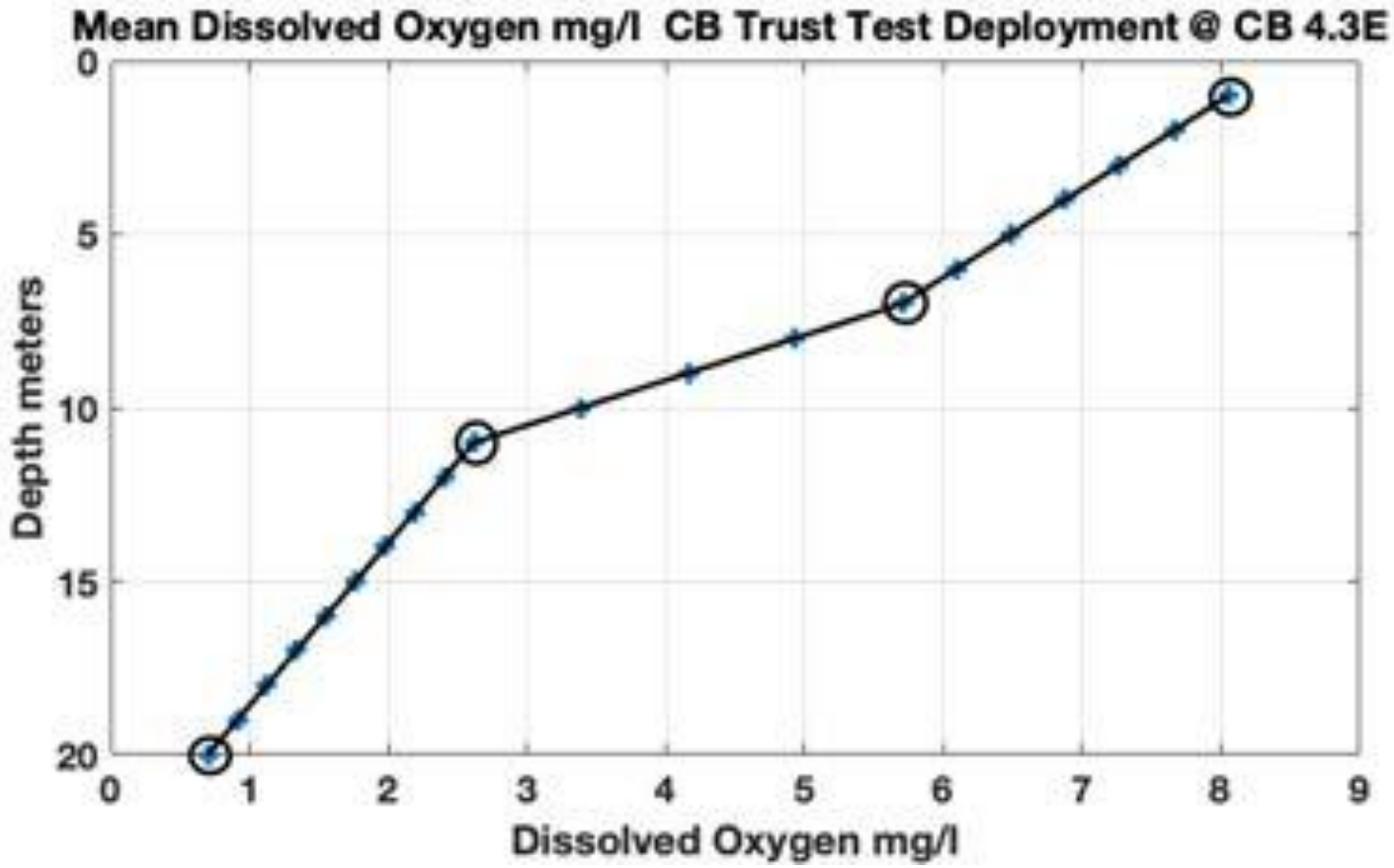
IOOS Website raw data



* Missing data at 1m filled in with greater value of <100 % saturation OR measured value at 7 m>
- 16 m sensor malfunctioned shortly after deployment. Data missing.

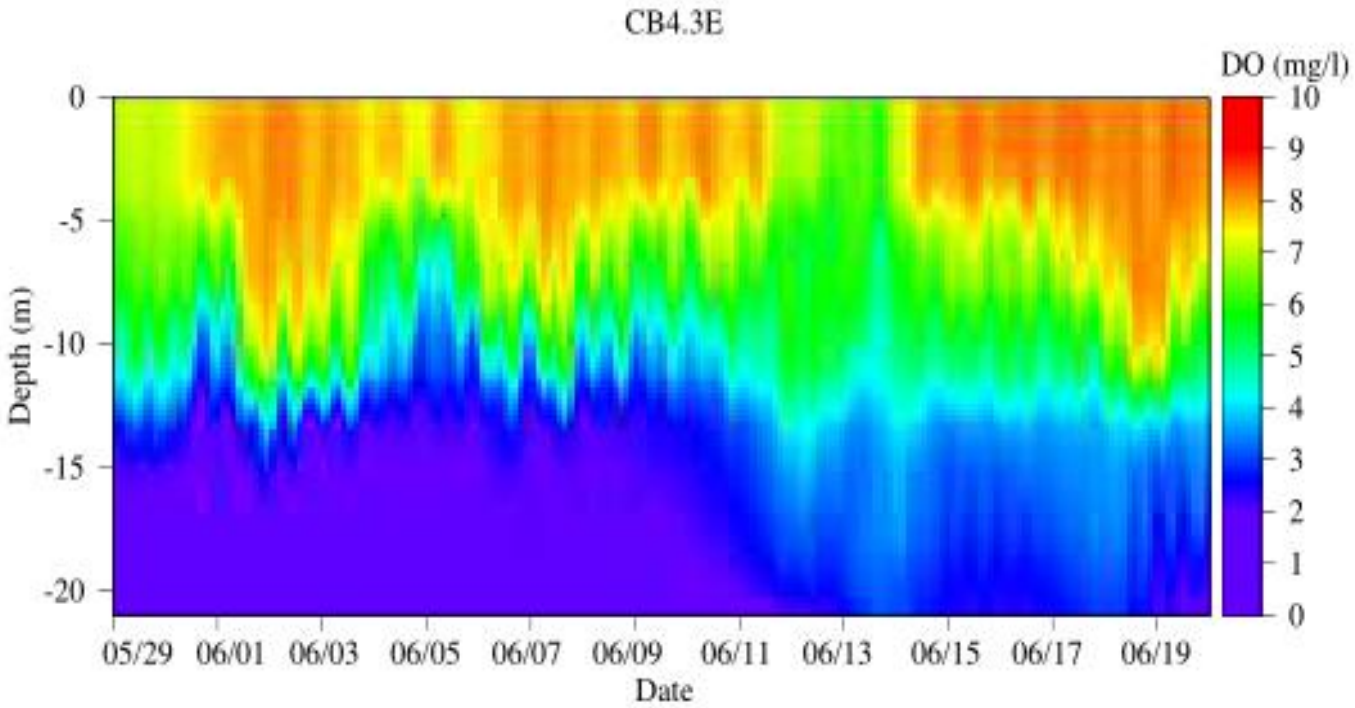
* Make sure all data manipulations programmed in S9 database to covert raw sensor data to engineering values (particularly Pressure, Conductivity, and Salinity)

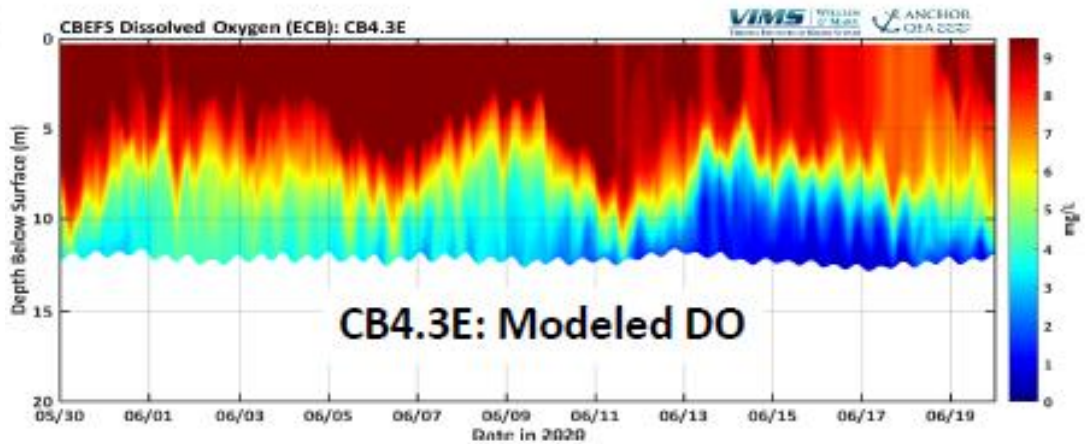
“Monthly Mean DO” (3 weeks) for June 2020

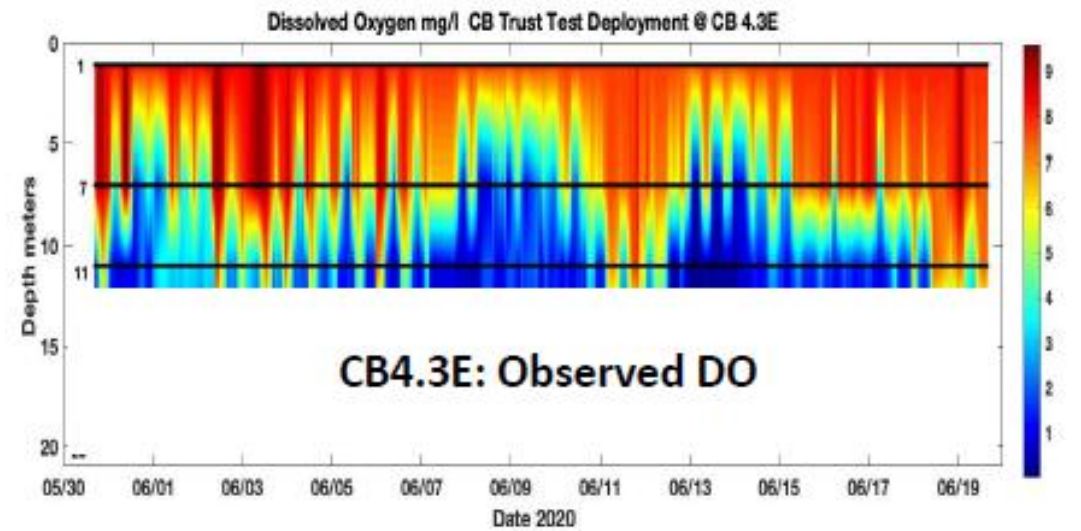


First look model comparisions…

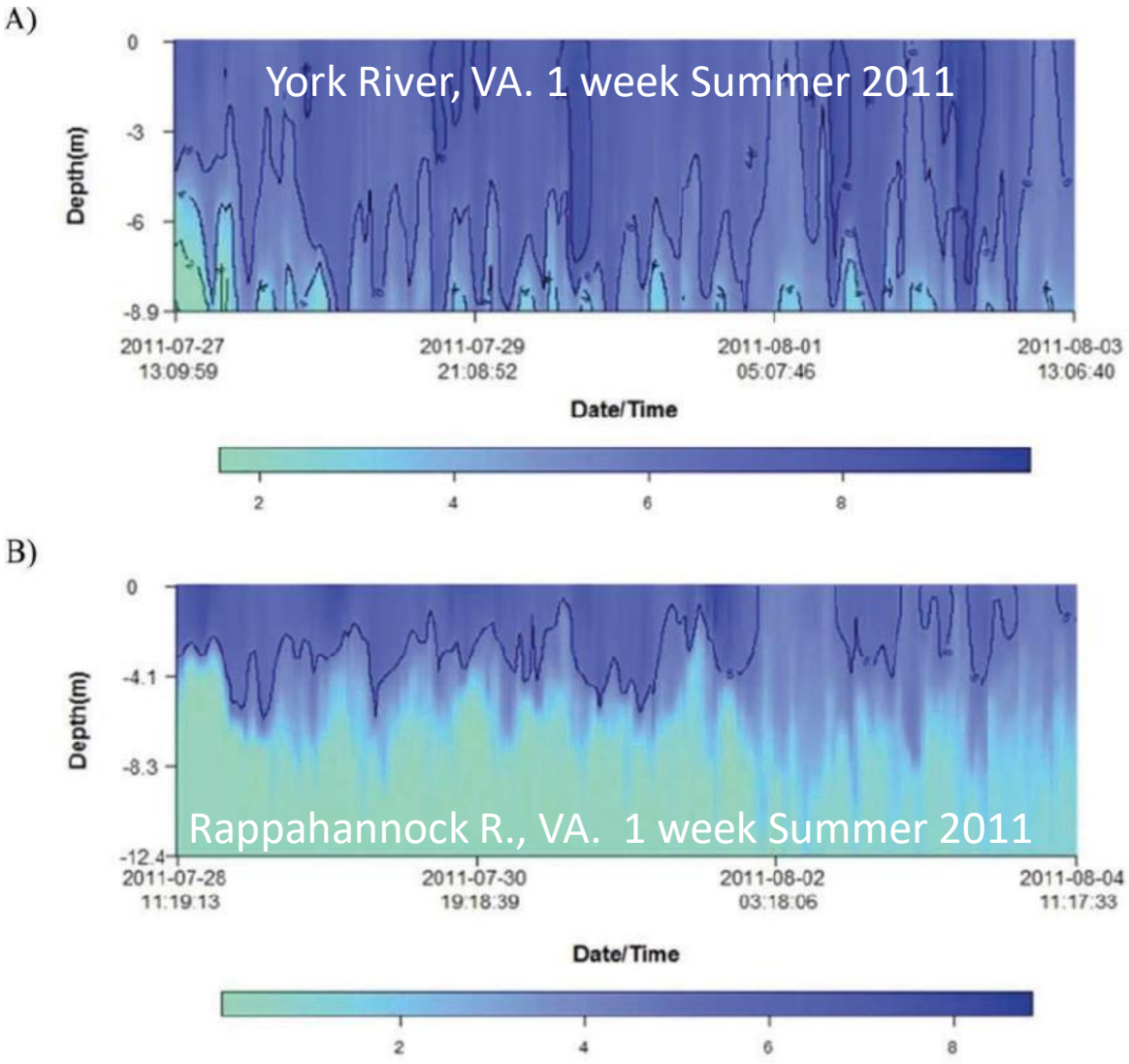
CB3D-ICM 1994



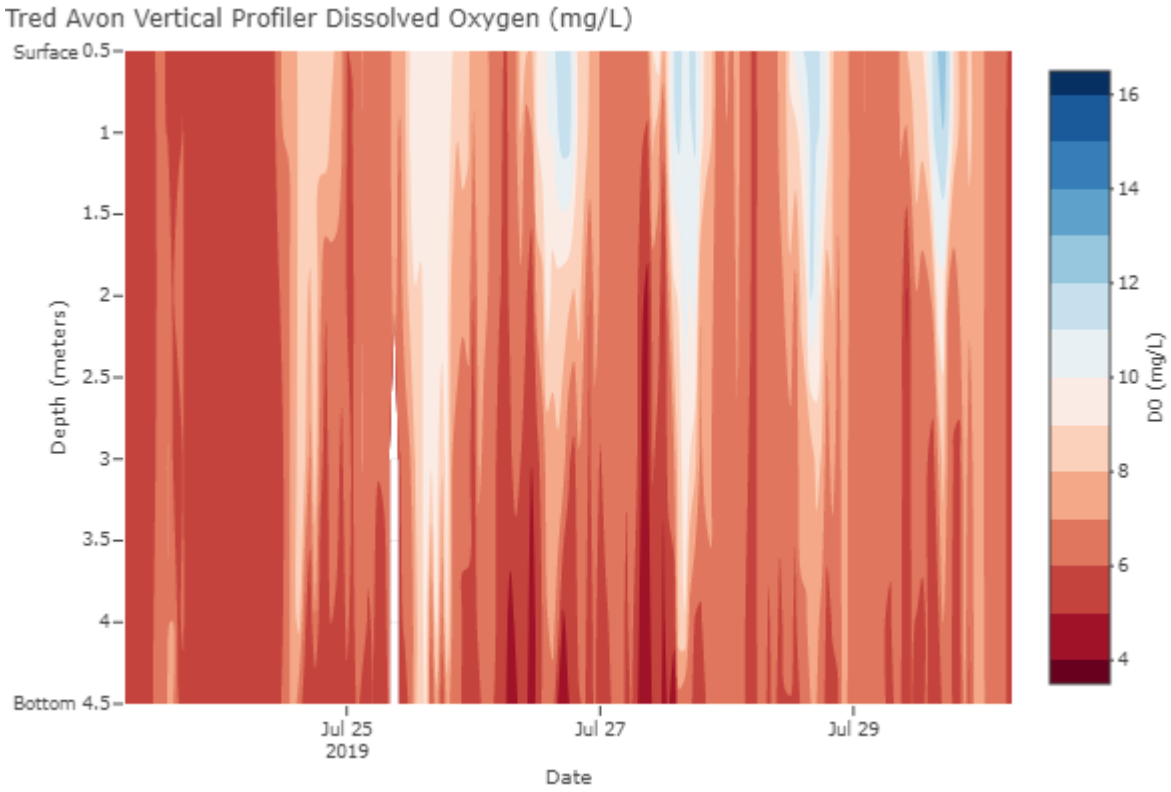




Other DO profile examples from Chesapeake Bay tributaries

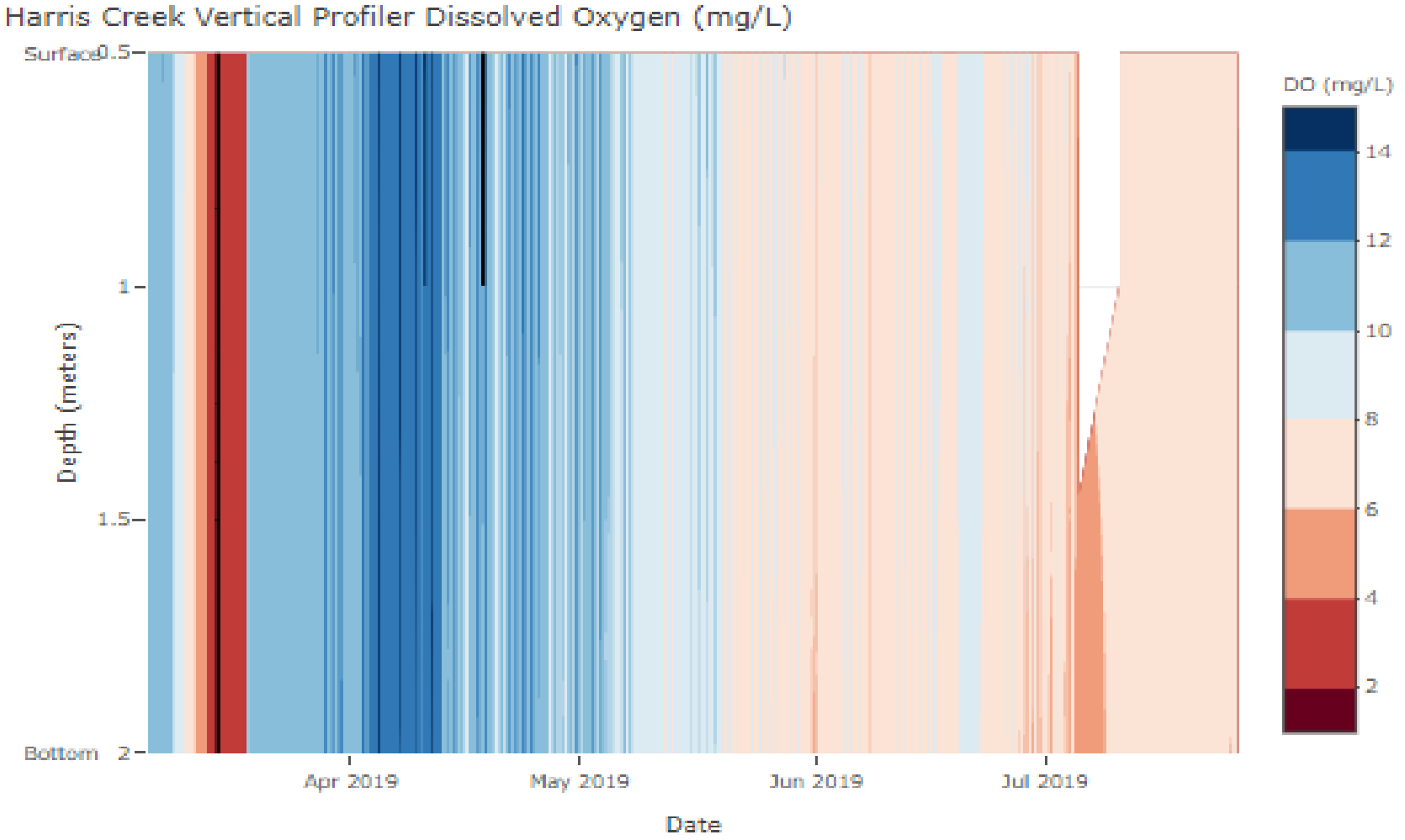


Water Quality Profiler data
(Tuckey and Fabrizio 2016)



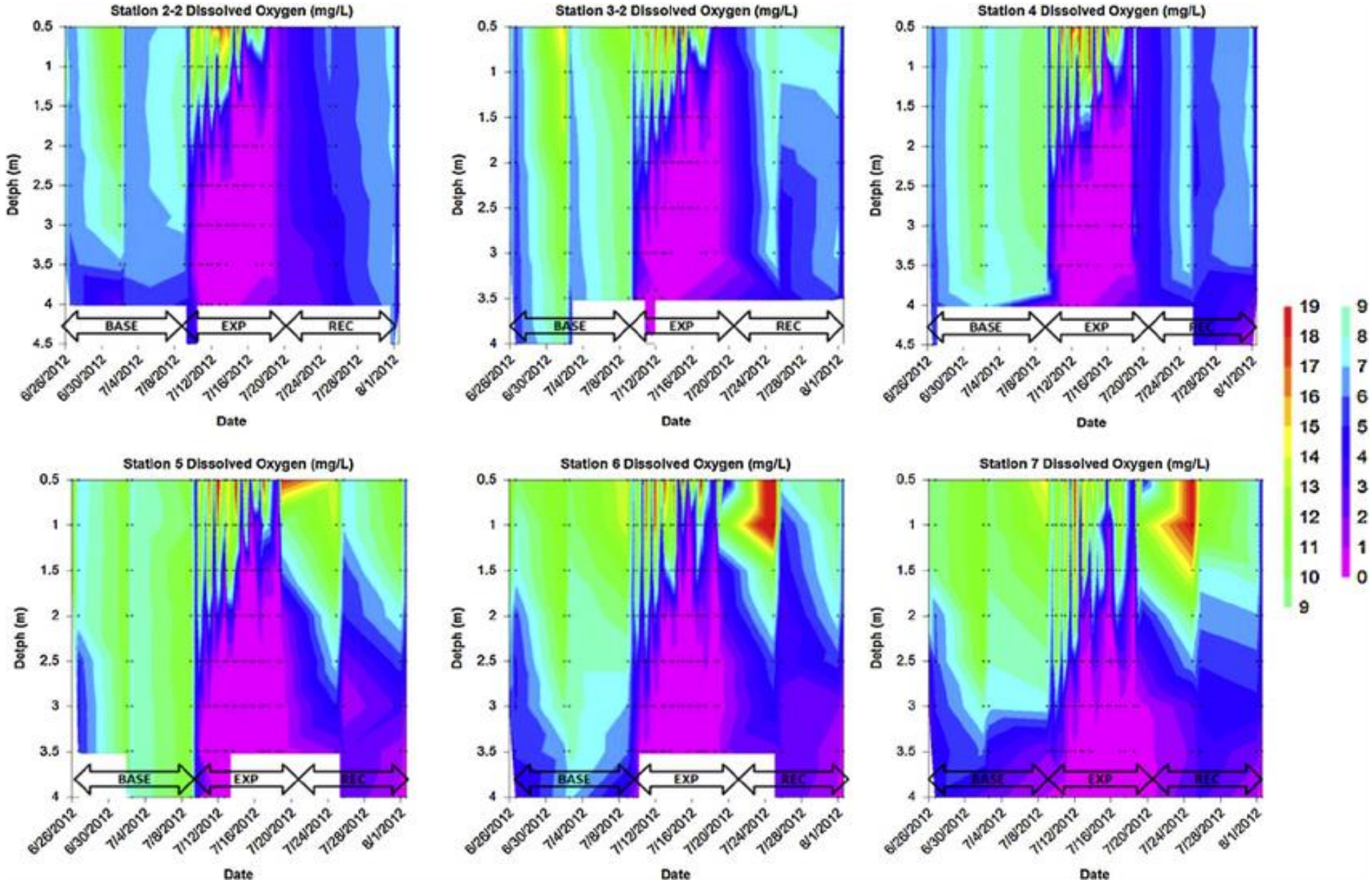
MD DNR Water Quality Profiler - hourly
About 1 week, 4.5meter depth, Tred Avon River
July 26- July 30, 2019

M. Trice
MD DNR



M. Trice
MD DNR

*Data are provisional and have not yet been through our rigorous Quality Assurance procedures.



L. Harris et al. 2015. Rock Creek MD

Issue

17 years with no significant updates adopted in the CBP to address measurement and reporting on short duration criteria underpinning our water quality standards

AFTER 17 YEARS WE NEED ACTIONS TO ADOPT and ADAPT OUR PROGRAM

Performance Assessment
Has not changed.
17 years of nothing more than 'marginal' assessment of Bay criteria seems beyond time to adapt as capacity declines

AFTER 17 YEARS WE NEED ACTIONS TO ADAPT

WE NEED NEARTERM COMMITMENT AND IMPLEMENTATION OF UPDATES TO THE PROGRAM TO MEASURE WATER QUALITY STANDARDS ATTAINMENT

MANAGEMENT and POLICY OPTIONS

Update data collections and analyses through revised investments and programming

- Apply existing analyses to data with improved resolution in space and time
- Approve new data interpolation procedures
- Approve new methods of data interpretation

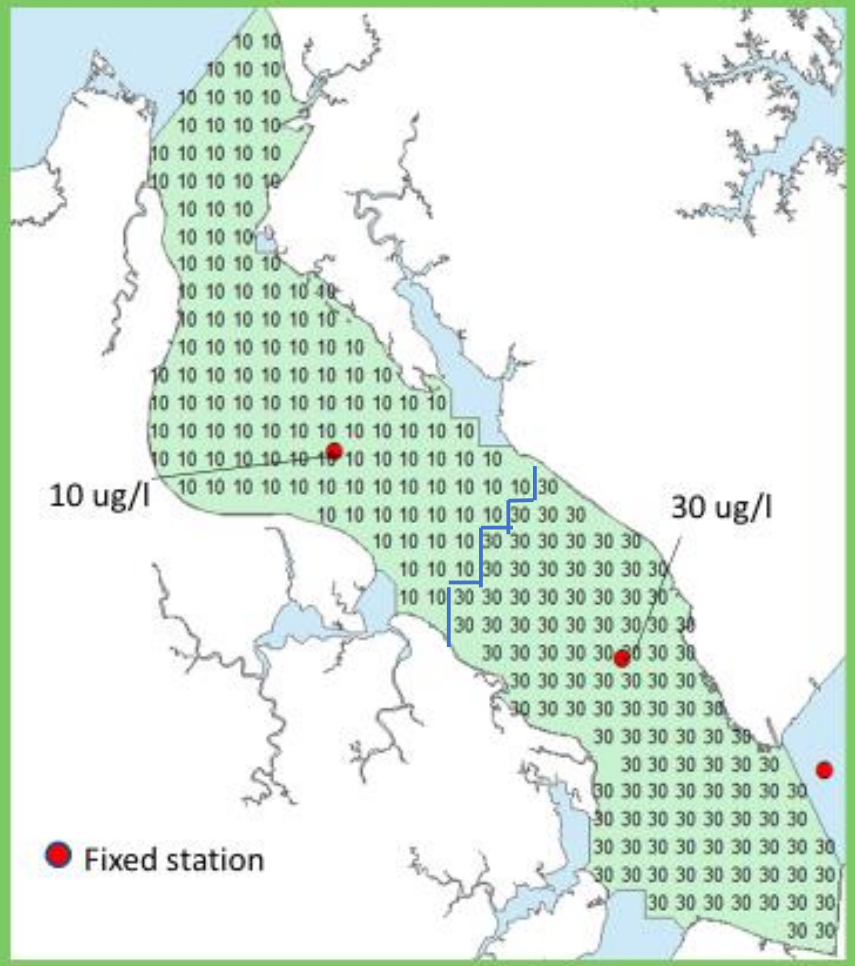
No new data
Sustain existing monitoring

- Update accepted analyses
- Use existing data with new rules of interpretation
- Revise the statements of the standards to simplify assessment and statement of protection

This is an IDW interpolation with 2 stations on CHLA, lower James River.

The Interpolator fills "in" and "out" so that we can calculate the aerial extent of exceedence.

Note: It does not create or rely on any statistical model of spatial variation (e.g., a variogram).



Interpolation of Dataflow provides insights on variability missed in this case. Almost nothing actually equals 10 ug/L or 30 ug/L around those two stations. Important for criteria assessment and tracking progress.

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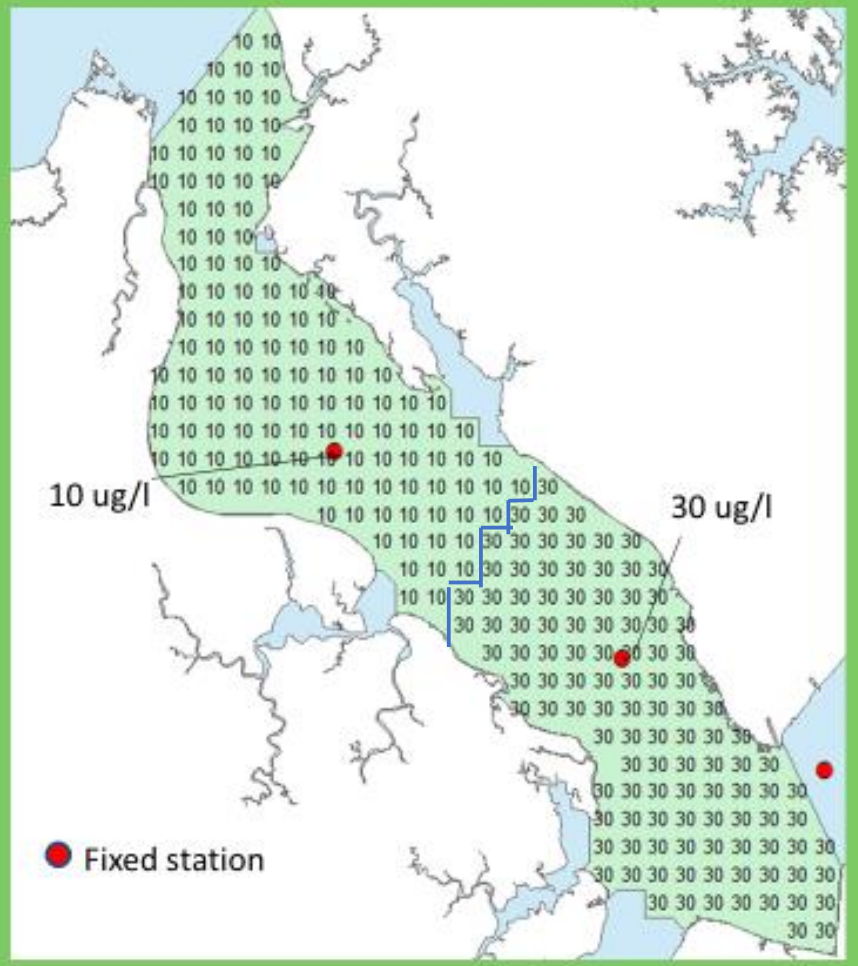

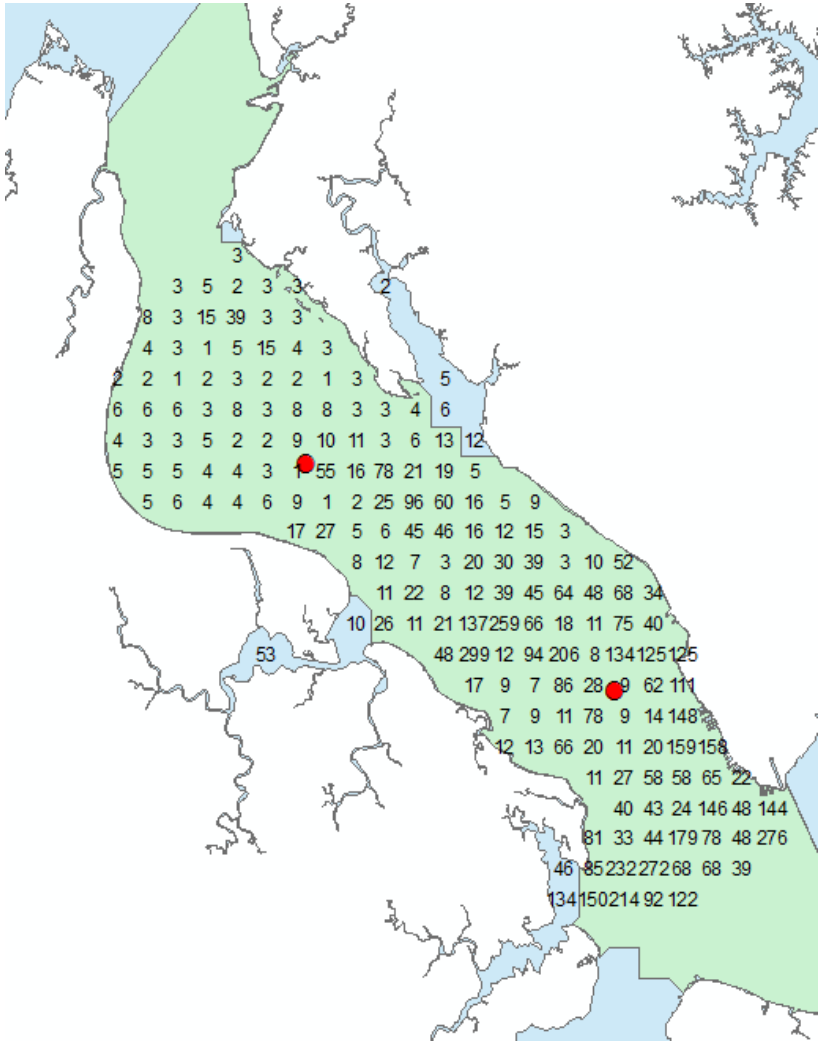

And there are opportunities to get single day, baywide assessments with alternate assessment protocol strategies, e.g. Hi-res satellite imagery

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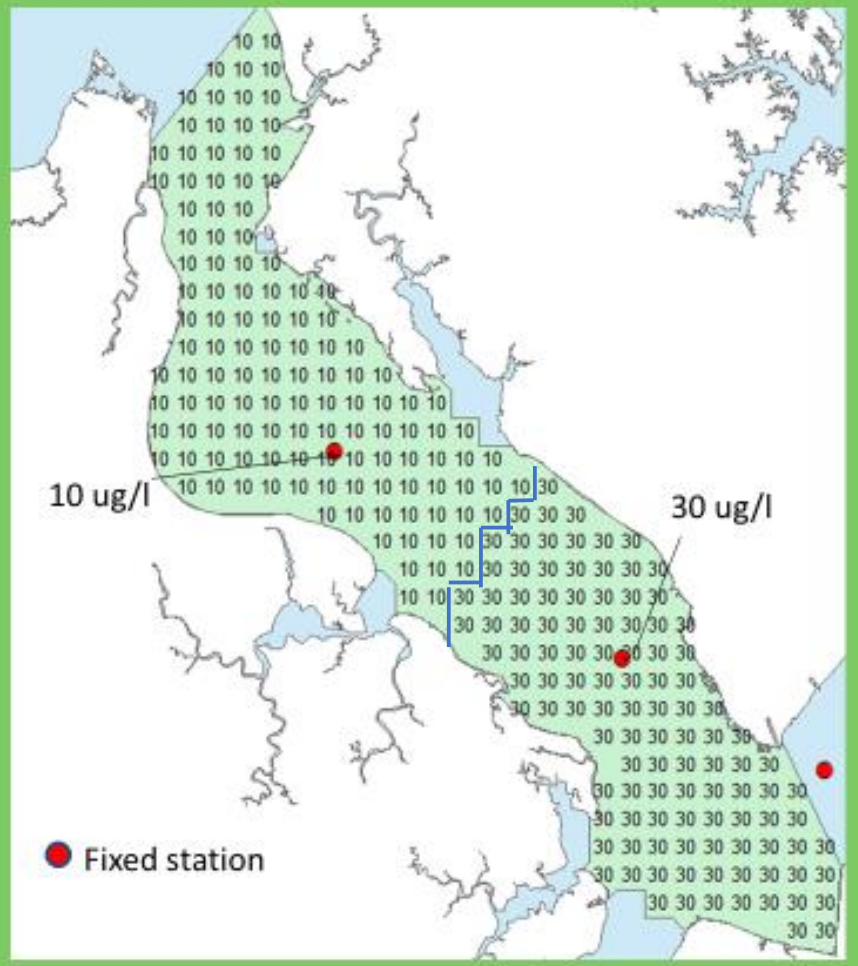
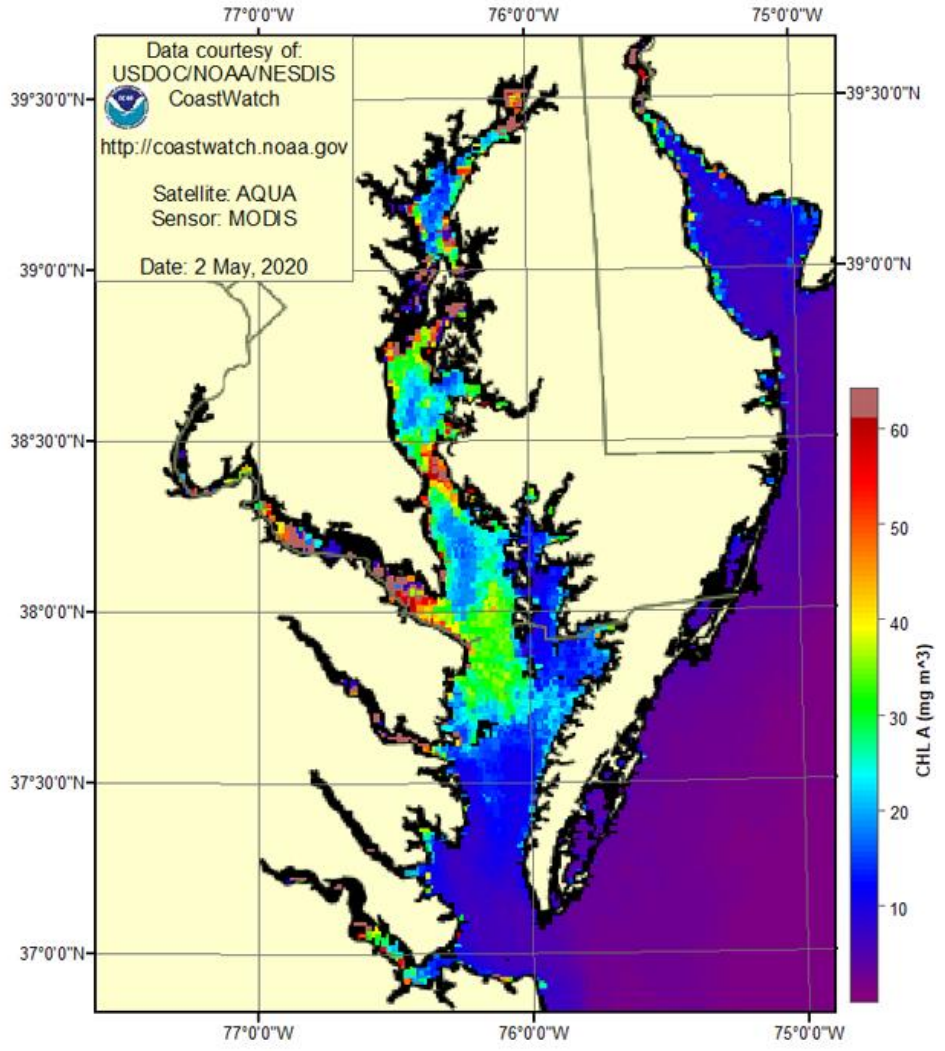
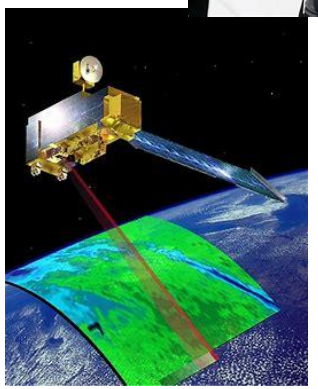
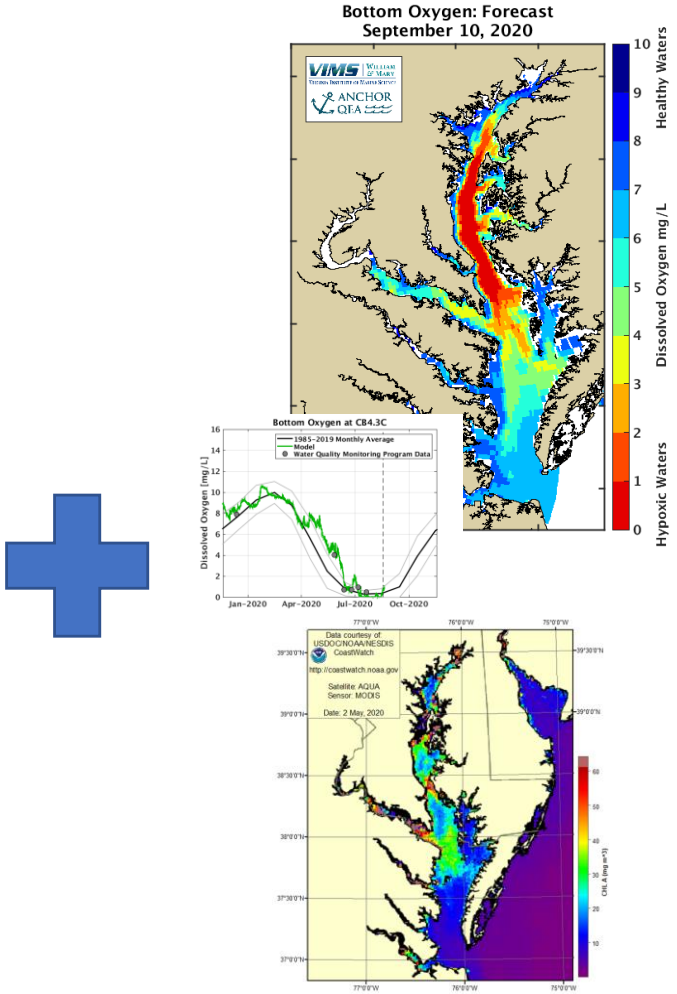




We have ripe opportunities to expand use of our toolbox to estimate conditions over much of the Bay and its tribs



Update integrated monitoring approach



Update analytical and assessment approaches

Improved capacity
Enhanced Assessments

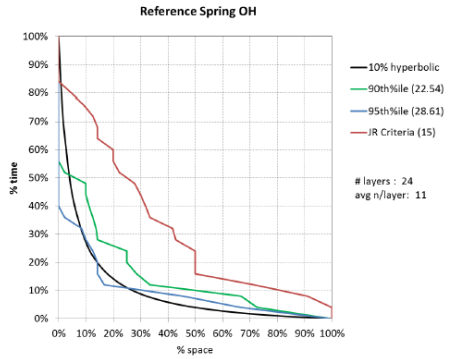


Figure 4b. Spring oligohaline CFD curves for chlorophyll *a* from reference water quality conditions.

Thank you ☺