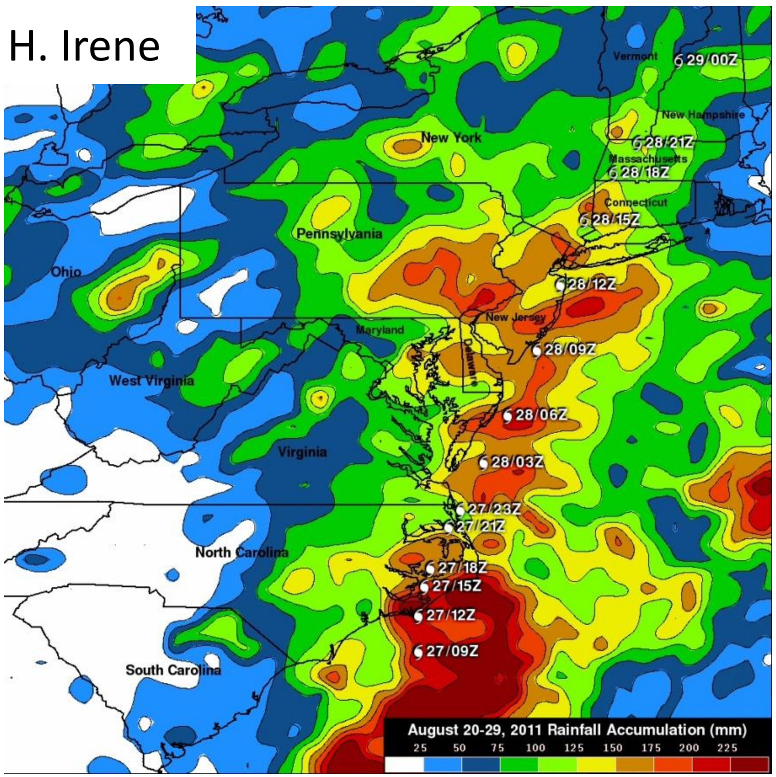
2011 Storm Effects Meeting Summary
CBP STAR Topical Meeting
April 19, 2012

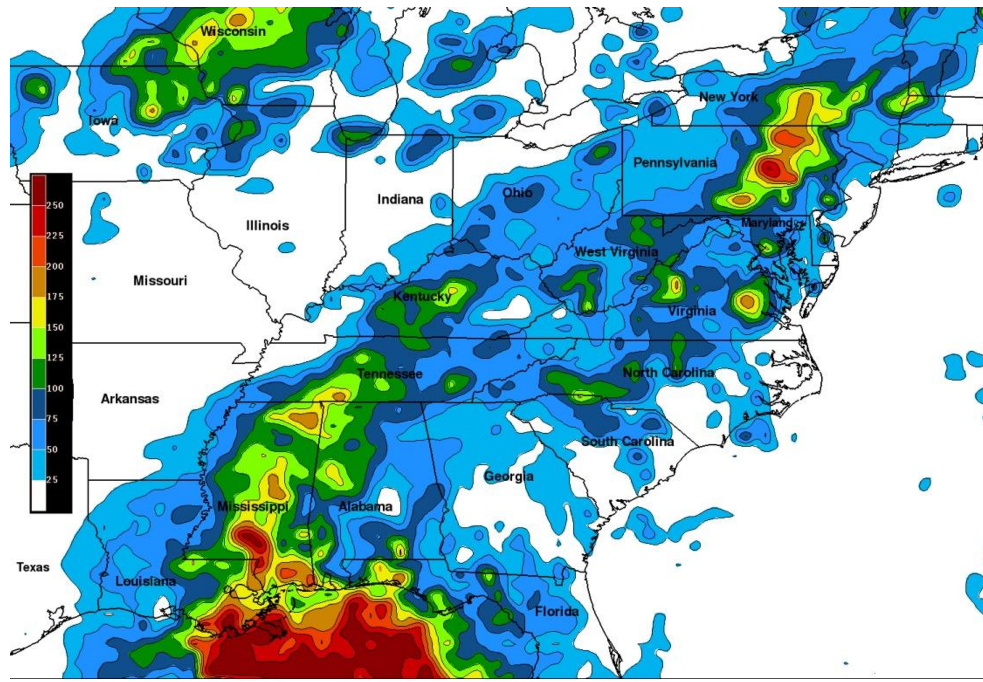
Peter Tango
USGS@CBPO
STAR Coordinator
STAC Meeting Presentation
June 19, 2012

Hurricane Irene and Tropical Storm Lee delivered significant rainfall to the Bay region

H. Irene



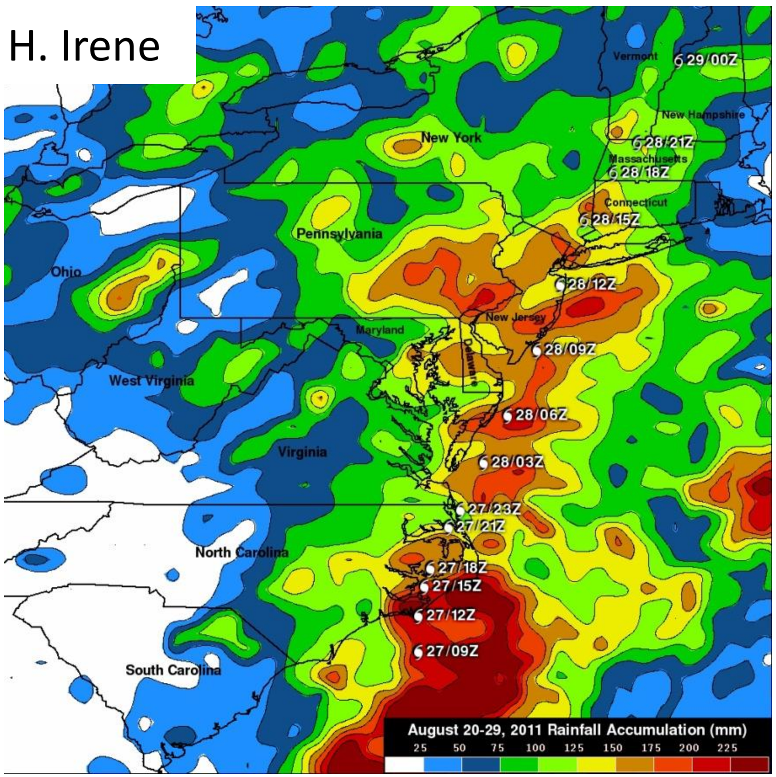
TS Lee



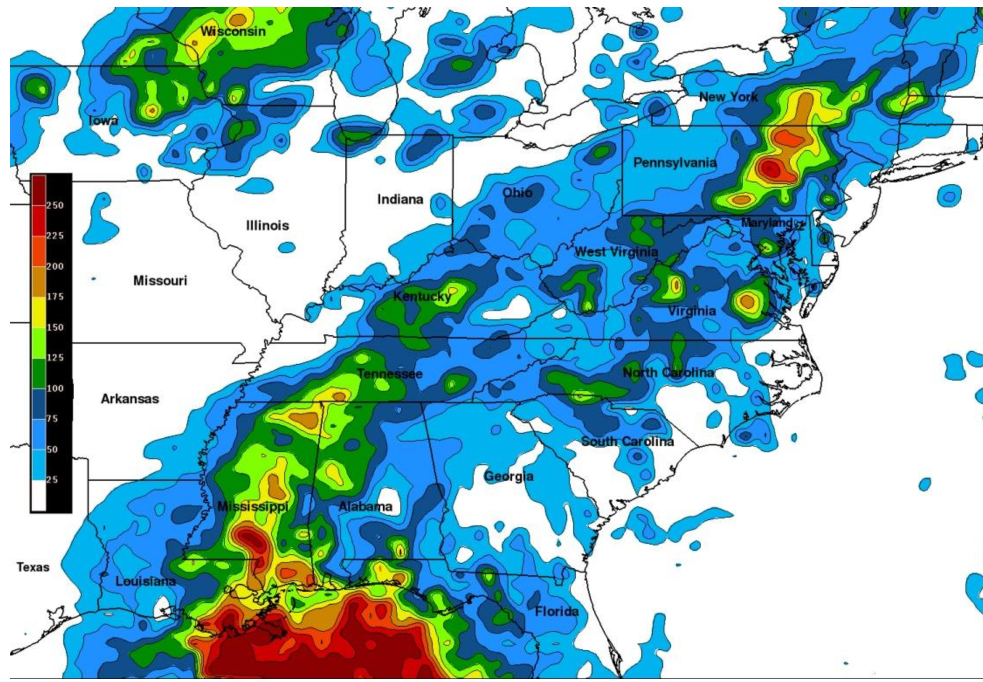
www.nasa.gov 2011 hurricane archives pages

Hurricane Irene and Tropical Storm Lee delivered significant rainfall to the Bay region

H. Irene



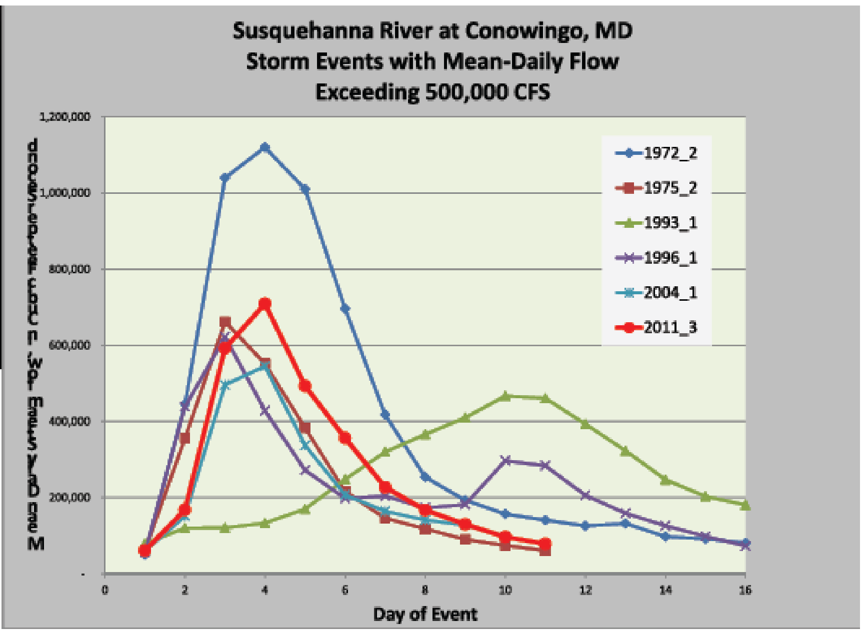
TS Lee



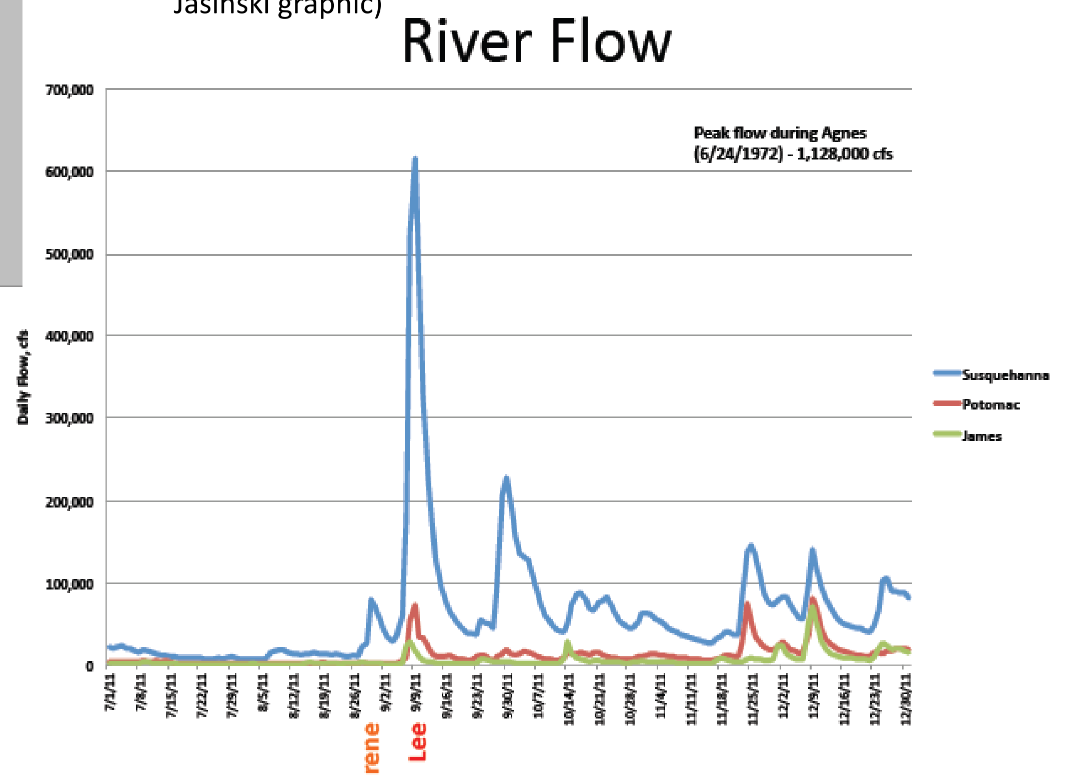
www.nasa.gov *2011 hurricane archives pages*

- ***What happened in the watershed?***
- ***What happened in the Bay?***
- ***How will this impact the Bay in 2012?***

Susquehanna River - Flow Record Books!
Less effect in the Potomac and James Rivers.

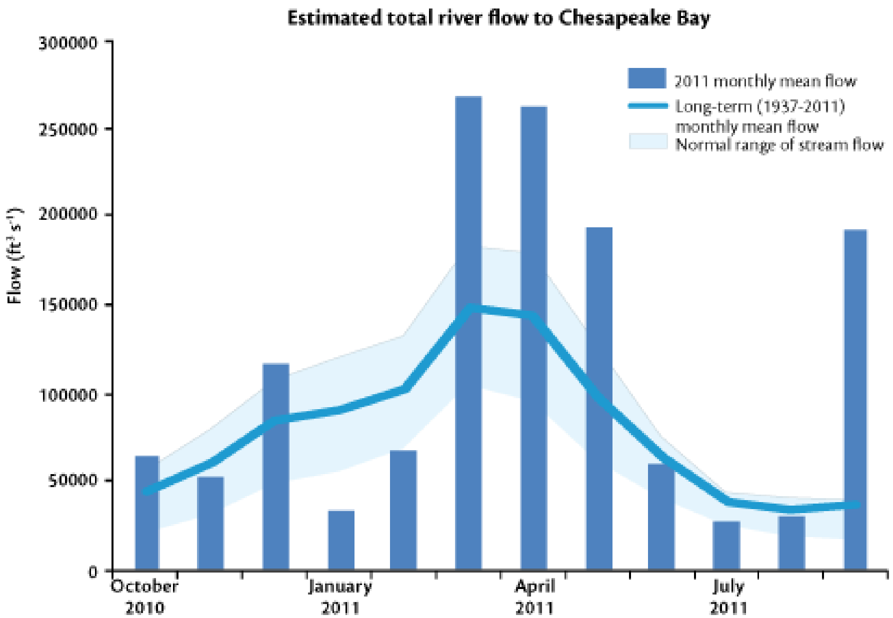


2011 events: Potomac and James River basins were affected more in November and December than August and September (USGS data, D. Jasinski graphic)



2011 events: peaked at 778K cfs
2nd to H. Agnes for Mean-Daily Flow associated with a storm event (USGS).

2011: Much more than just the summer storms

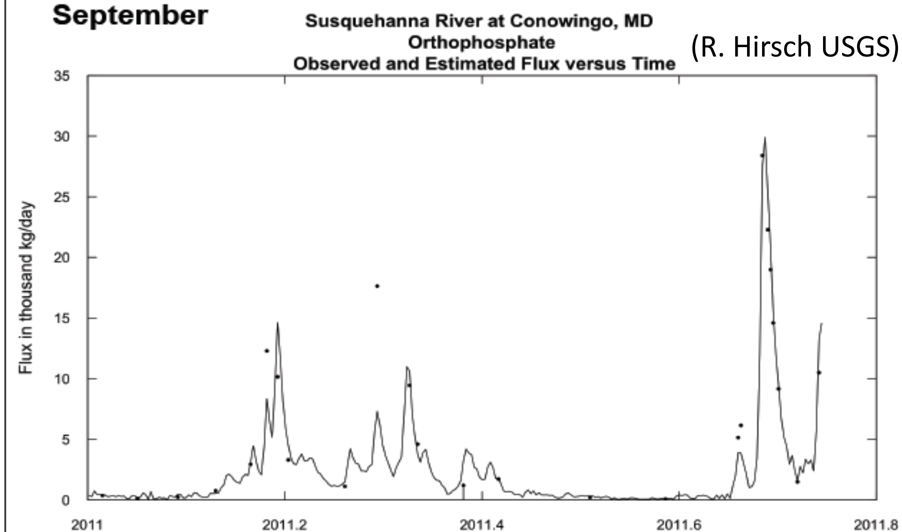


IAN Ecocheck webpage

"March through May had the highest three-month average flow ever recorded from the Susquehanna River, the Bay's largest tributary. By June, that freshwater had driven salinity levels at many Maryland monitoring stations to record lows for the month." (Bay Journal)

March, April and May of 2011 combined, contributed 32% more orthophosphate than the month of September

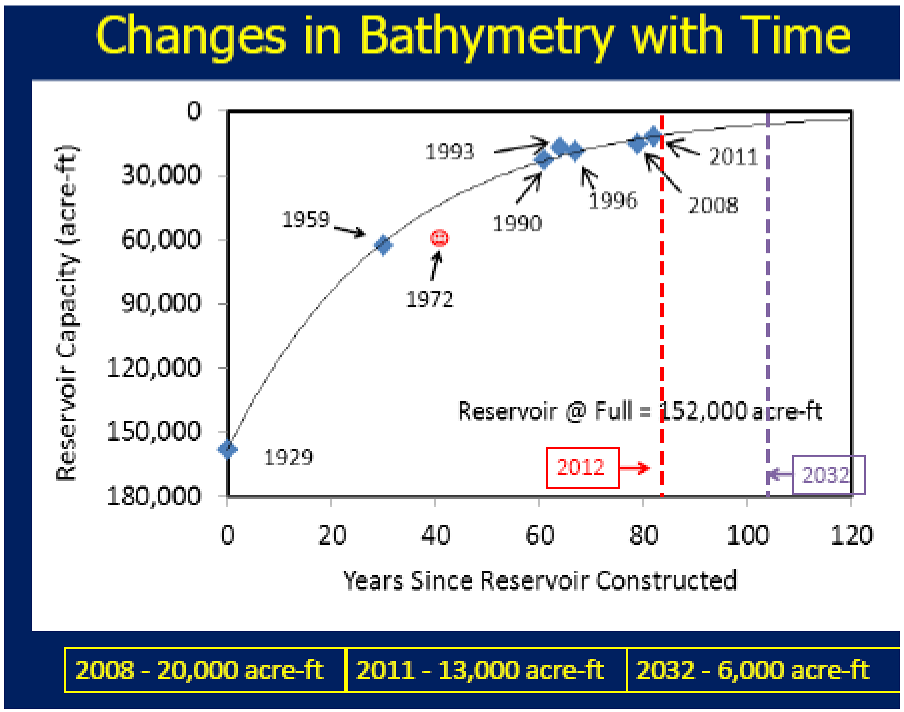
(R. Hirsch USGS)



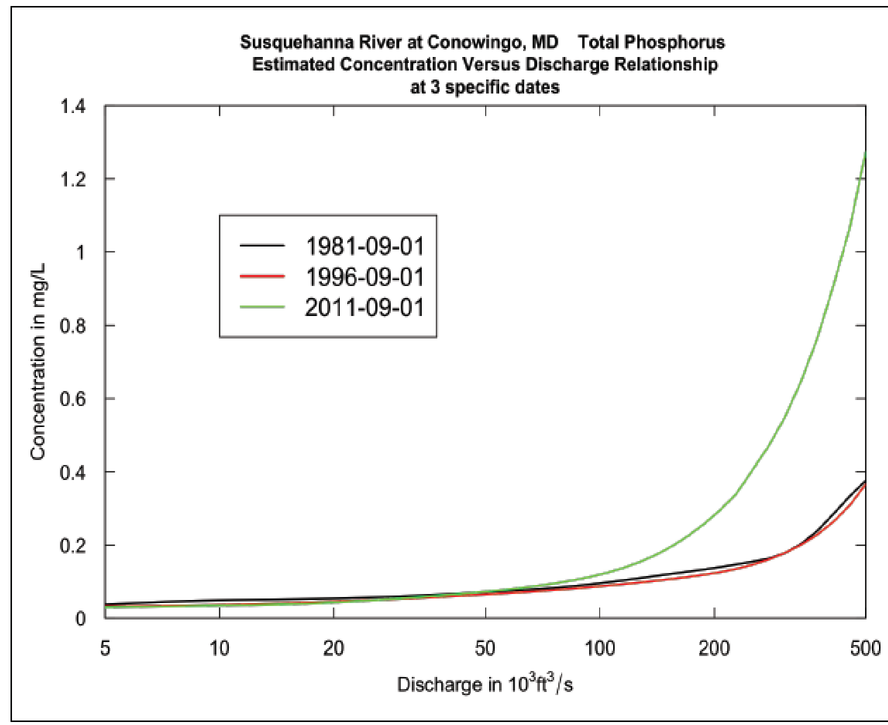
Management messaging (R. Hirsch USGS)

- TP stable or declining at low to moderate flows.
  - Orthophosphate is increasing in most flows and seasons
- TN decreased concentrations in almost all flows and all seasons.
  - Slight indication increase at very low spring flows
  - Increase with tropical storms
  - Annual variability in TN flux

Management message: Lower and lower flows are interacting with reservoir capacity in Conowingo Reservoir and changing relationships for what is being delivered to the bay. (R. Hirsch USGS)

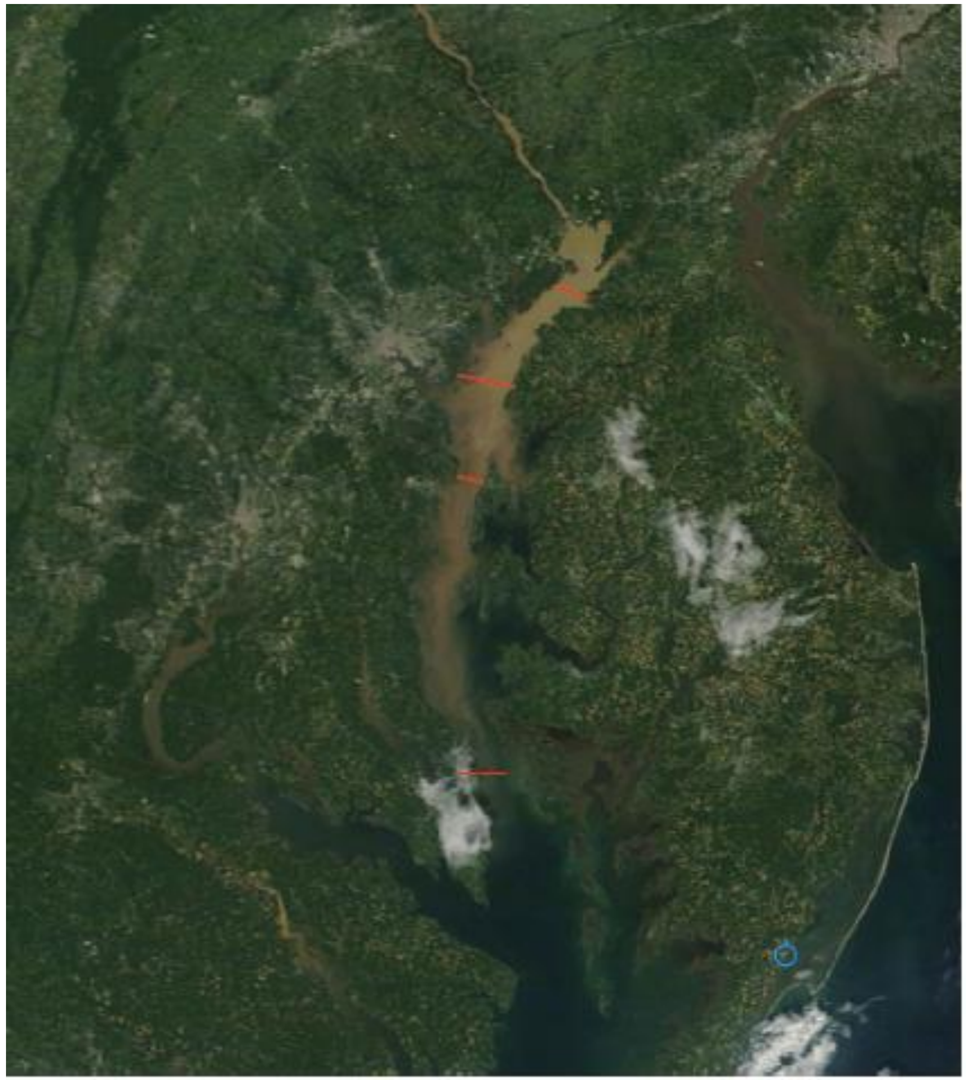


USGS M. Langland et al.



USGS R. Hirsch

Popular Question: Where did all the sediment (and water and nutrients) go?

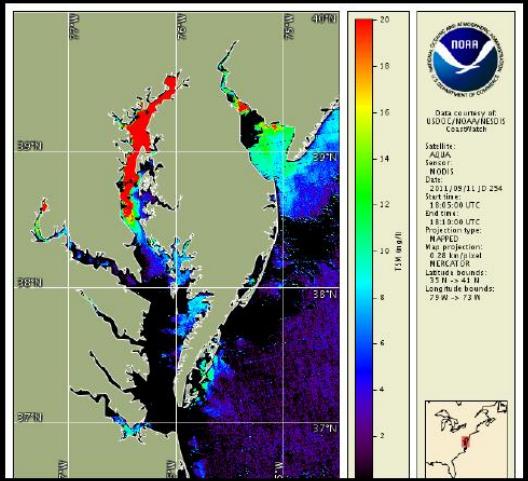


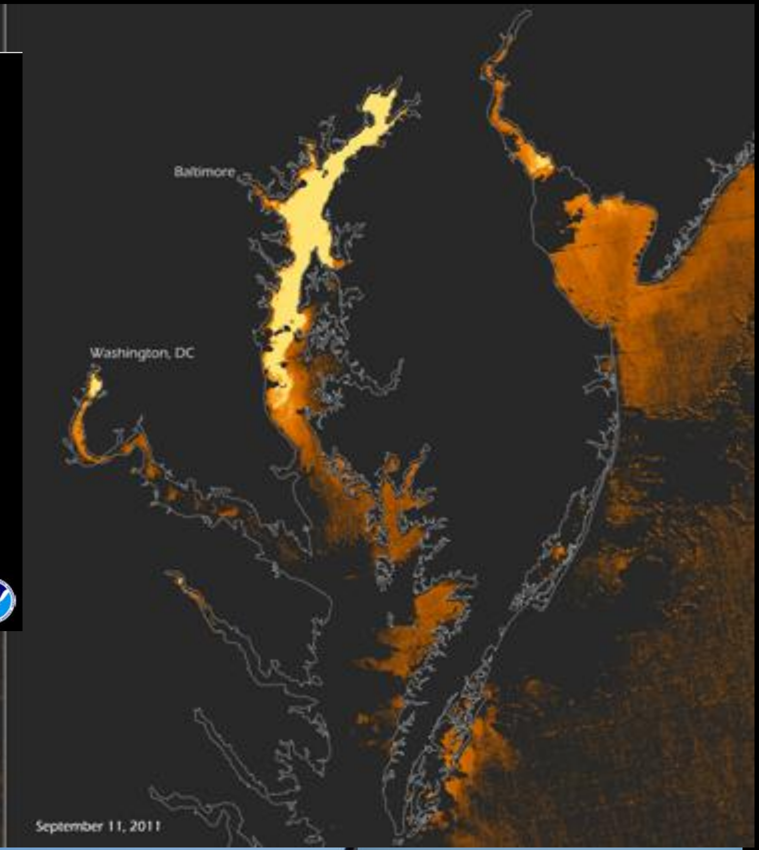
NASA true color imagery

Remote Sensing was used to effectively track Total Suspended Matter in Chesapeake Bay (M. Ford NOAA)

Total Suspended Matter (mg/l)

Lee Response – Ondrusek et al.





Lee Response – Ondrusek et al.

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ELSEVIER

The development of a new optical total suspended matter algorithm for the Chesapeake Bay

Michael. Ondrusek [a,*], Eric. Stengel [a], Christopher.S. Kinkade [b], Ronald.L. Vogel [c], Phillip. Keegstra [d], Craig. Hunter [e], Chunai. Kim [f]

[a] NOAA/NESDIS/STAR/SOCD, Camp Springs, MD, USA
[b] NOAA/NOS, Coastal Services Center, Annapolis, MD, USA
[c] SM Resources Corp., NOAA/NESDIS/STAR/SOCD, Camp Springs, MD, USA
[d] SP Systems Inc. NOAA/NESDIS/STAR/SOCD, Camp Springs, MD, USA
[e] Moss Landing Marine Laboratory, Moss Landing, CA, USA
[f] Riverside Technology, Inc., NOAA/NESDIS/STAR/SOCD, Camp Springs, MD, USA

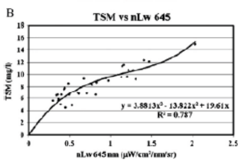
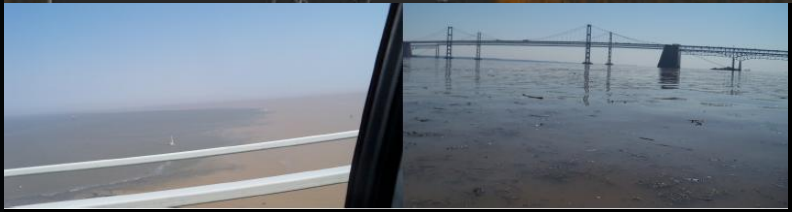


Fig. 4. Plots of 2008 TSM versus in situ measured nL_w (645) corresponding to the high resolution MODIS band 1. A) Predicts TSM using a linear regression fit through the data. B) Same data plotted in A) except with a 3rd order polynomial fit to the data with the y-intercept forced through zero.



Baltimore

You are here!

Washington DC

Chesapeake Bay

Atlantic Ocean

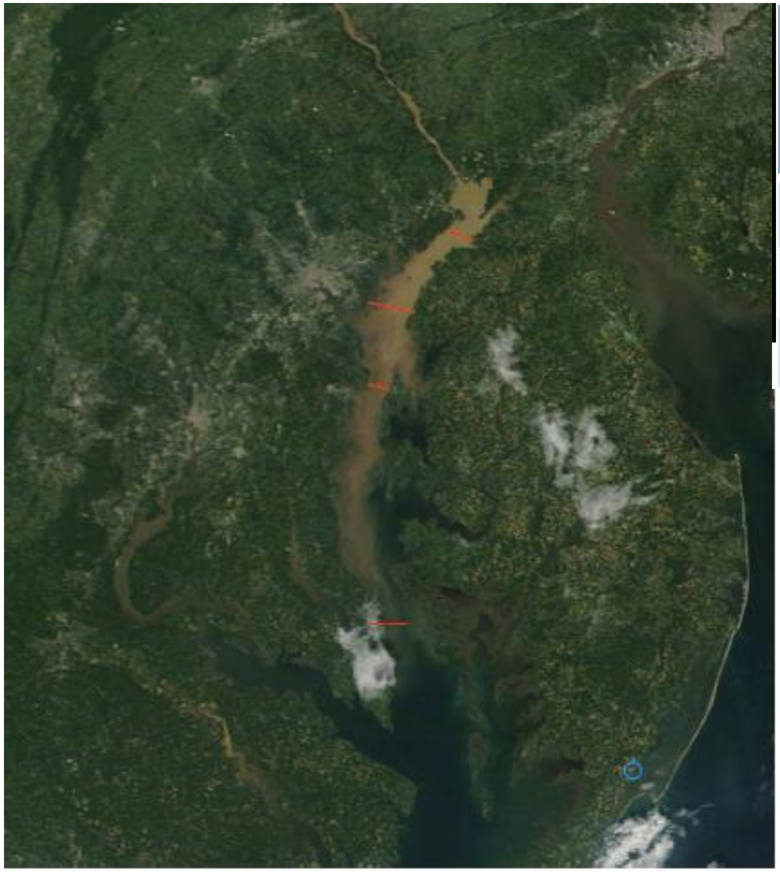
On-the-water and in-situ monitoring still tracks water quality conditions on cloudy days ☺

VIMS, MD DNR, NOAA
buoys, vertical profilers

VIMS, MD DNR, VADEQ, ODU, DC
Chesapeake Bay Long term
Water Quality Monitoring Program

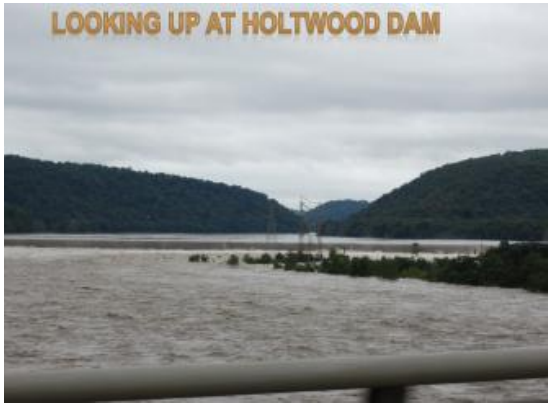
ConMon throughout the Bay and into the watershed (DNR, DEQ, USGS)

Back of the envelope distribution calculations suggest we are searching for a thin layer of sediment (JDB)



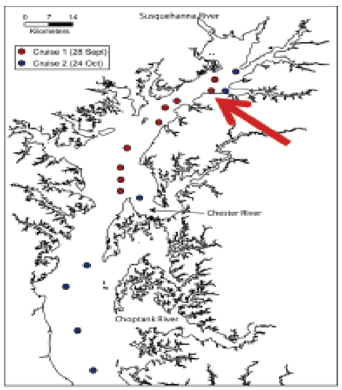
Tons of sediment through Conowingo Dam	Volume of sediment (ft3)	# of Dallas Cowboy Stadiums filled	Inches of deposition, assuming sediment distributed across cumulative area			
			Segment			
			CB1TF	CB2OH	CB3MH	CB4MH
11,000,000	328,000,000	3.16	2.41	0.86	0.46	0.22
15,000,000	448,000,000	4.31	3.29	1.17	0.63	0.29
19,000,000	567,000,000	5.45	4.17	1.48	0.80	0.37

J. Blomquist USGS

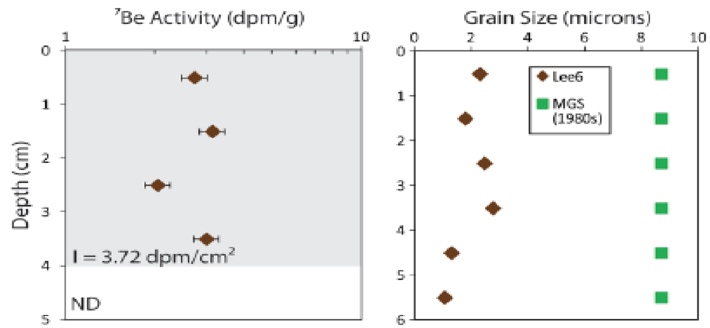


Some data seem to corroborate the idea of a thin layer sediment distribution in the upper Bay but more data is being evaluated.

Lee6

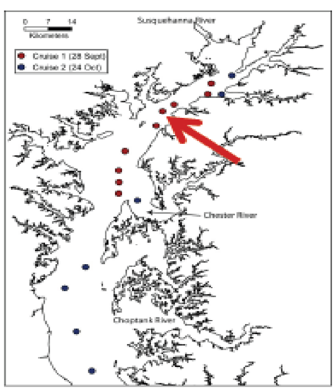


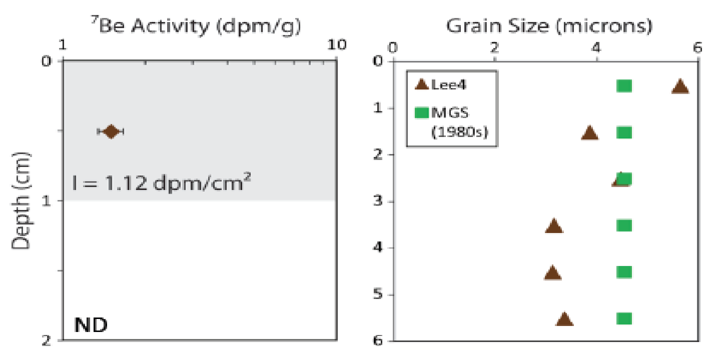
Similar to S&Z Site 10: 15-20 cm; noted that it could be overestimated



Lee deposition: 4 cm
But could be overestimate due to mixing

Lee4



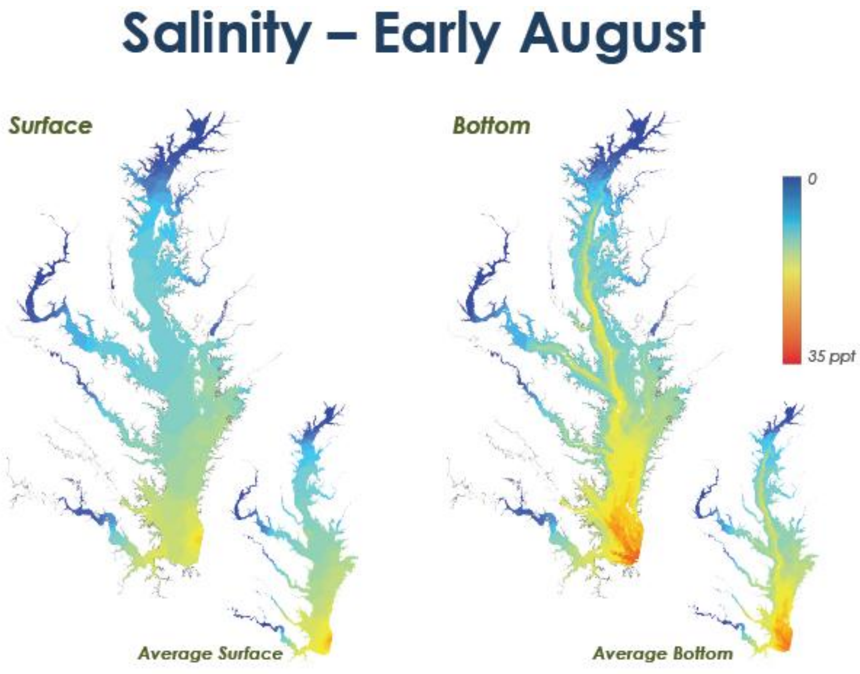


Lee deposition: <1 cm

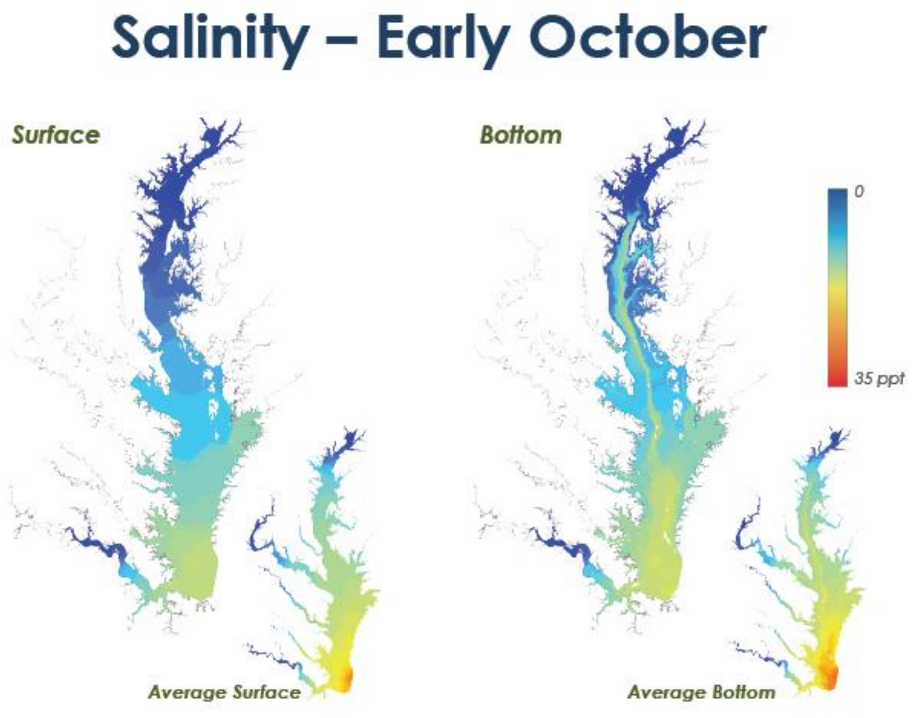
J. Halka MGS
C. Palinkas UMCES

"Storm flow volume could fill CB1, CB2 and CB3" (JDB)

Nearly average distribution

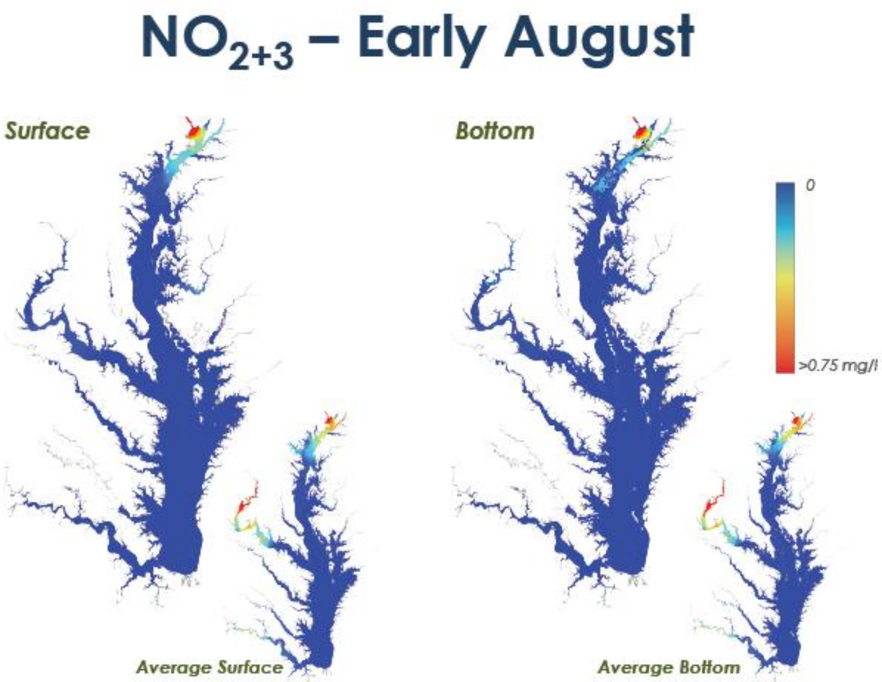


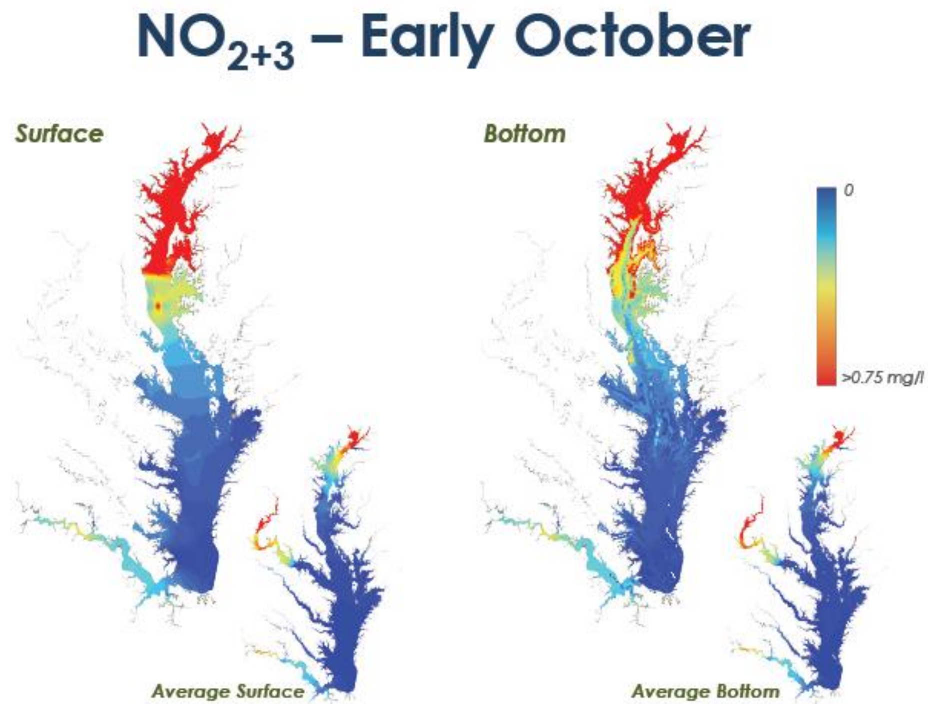
Below average conditions baywide. Freshwater extension well down the Bay.



D. Jasinski CEC

An early look at nutrient distributions after the storms shows a good dose of nitrogen delivered to and lingering in the upper Bay

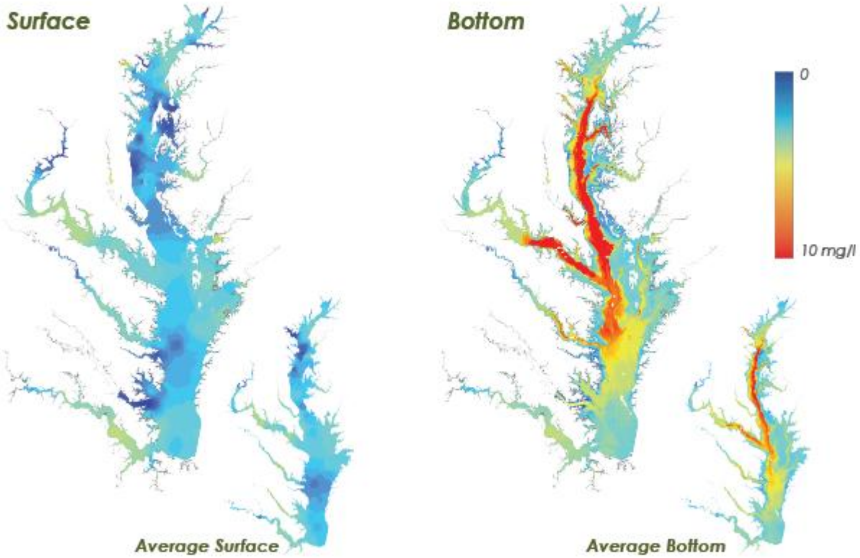




D. Jasinski CEC

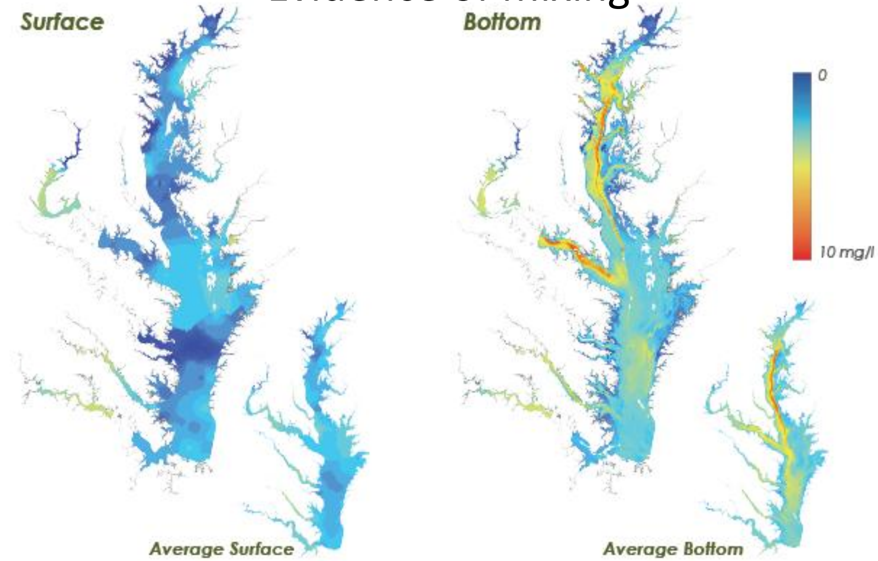
DO – Early August

Stratified mainstem, anoxic zone



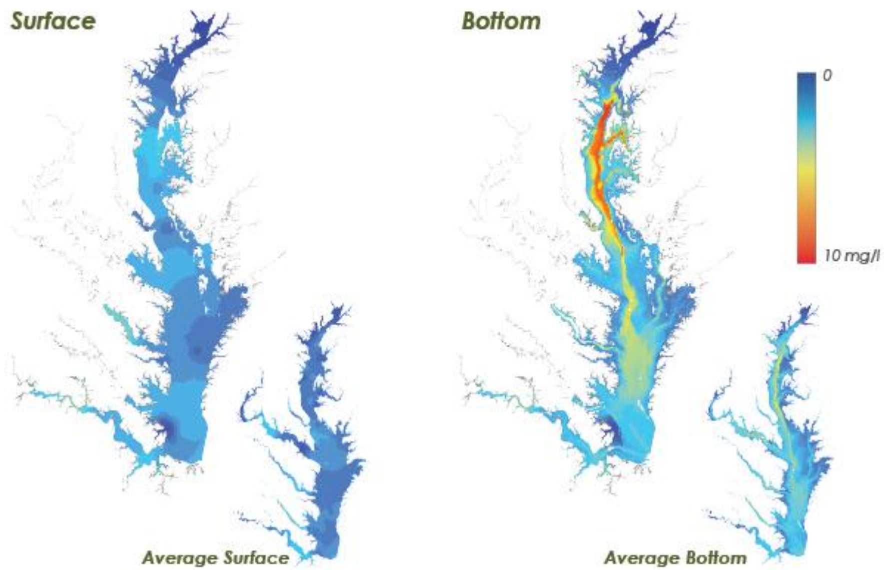
DO – Late September

Evidence of mixing



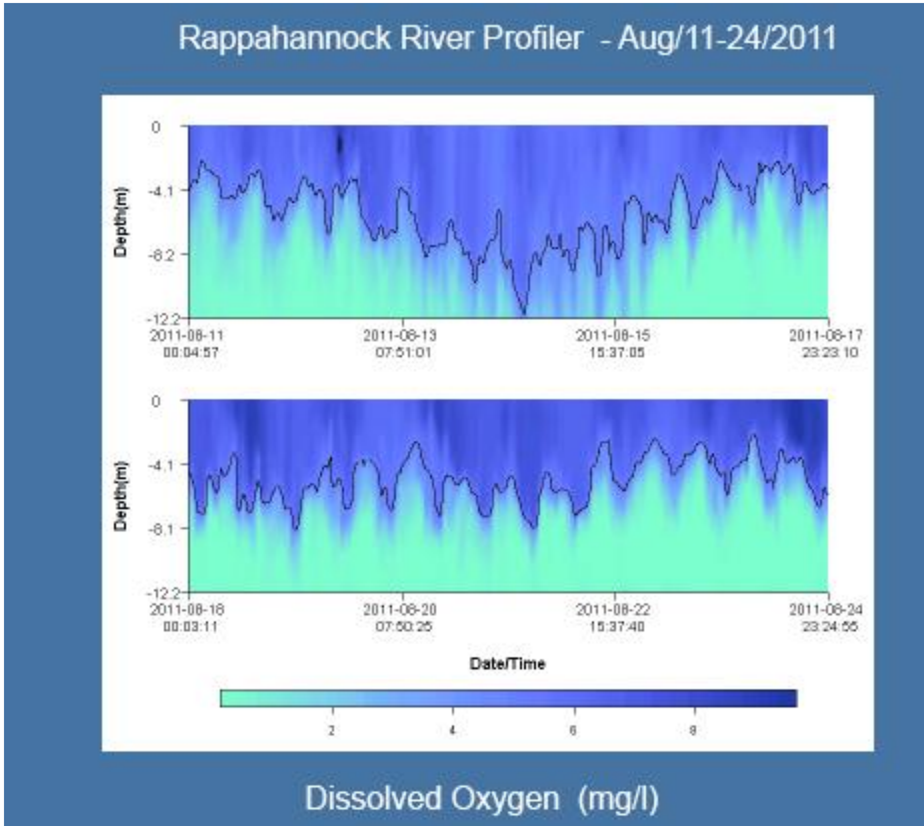
DO – Early October

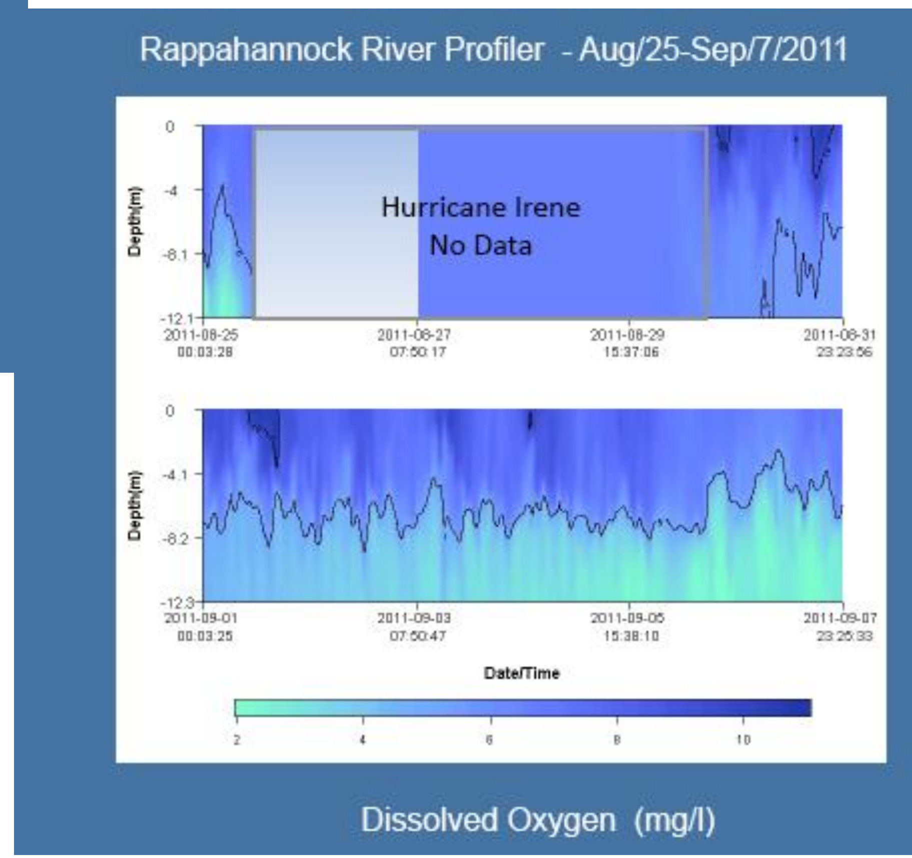
Restratified mainstem, anoxic zone



D. Jasinski CEC

Destratification and restratification observed in profile for the lower Rappahannock River

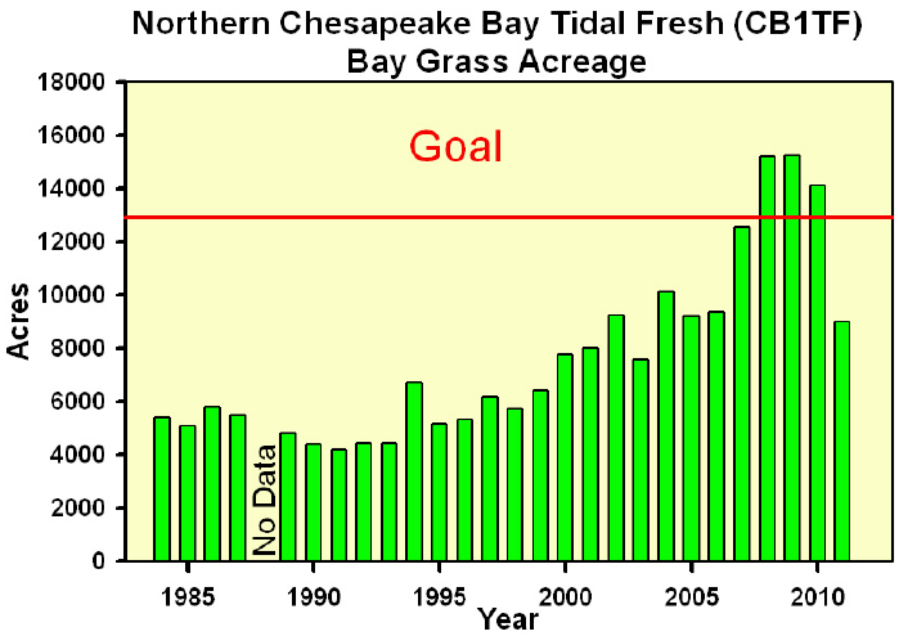




D. Jasinski CEC & VIMS

Living Resource Effects: SAV habitat conditions were generally just good enough survival in 2011

Upper Bay



Caveat: Upper Bay aerial surveys completed in late fall due to lingering post-storms turbidity.

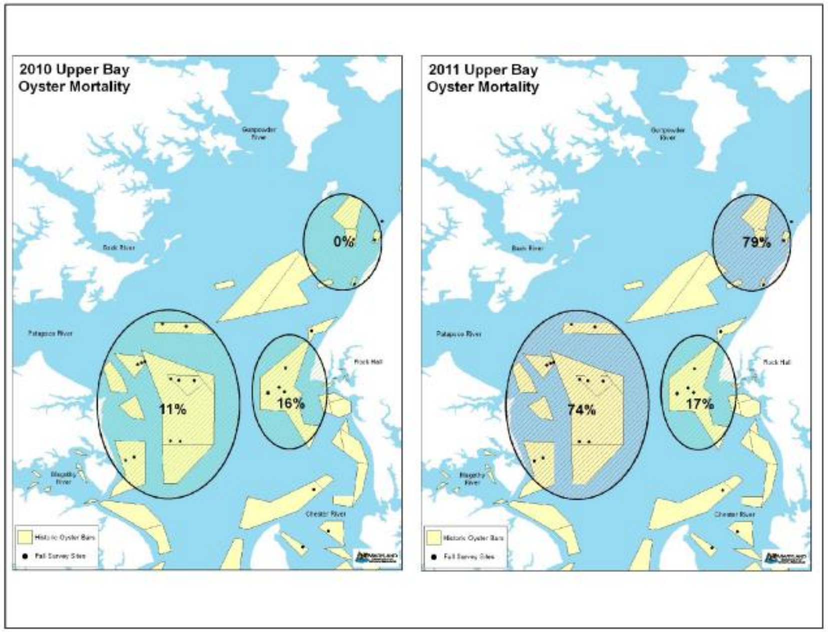
Lower Bay

- The mesohaline areas of the Bay?
  - Big increases in widgeon grass, will these larger beds persist?

- For Virginia
  - Most of the SAV declines in the region were due to eelgrass loss due to heat stress in summer 2010
  - Aerials taken before the storms
  - No big turbidity plumes OR salinity spikes
  - Impacts of storms are not anticipated to be appreciable

L. Karrh MD DNR
K. Moore VIMS et al.

Living Resource Effects 2011: Oysters experienced high mortality in the upper Bay but have excellent baywide survival



Flow impact to Oysters

- Highest overall oyster survival rate since 1985 (92%)
- More than double the survival rate of 2002
- 44% increase in oyster biomass in one year
- Dermo and MSX at all-time lows

(M. Naylor MD DNR)

Bacteria: South River relationships to storms suggested 0.5 inches of rain often produced bacteria levels out of compliance instead of the often cited 1 inch of rain. (D. Mueller, SRF)

Baywide benthos assessment showed little impact from the storms.
(R. Llanso VERSAR Inc.)

Next steps

- Communicating management-relevant messages.

- Developing Bay/basinwide Syntheses: Planning *Bay Response to 2011 Conditions* Meeting (1st week of December first guesstimate for timing).
  - 1.5 days
  - Opening Keynote: Historical storms perspectives.
  - Presentation Sessions:
    - e.g. Event detection,
    - Applications of improving technologies in event monitoring,
    - pulsing events implications to living resources,
    - Storm modeling-monitoring comparisons,
    - Urban stormwater
  - Poster session(s)
  - Summary plenary talks
    - Climate change and hydrology in the Chesapeake Bay Watershed (USGS)
    - Given changes and forecasts, management implications and concerns (UMCES)
  - Product summary