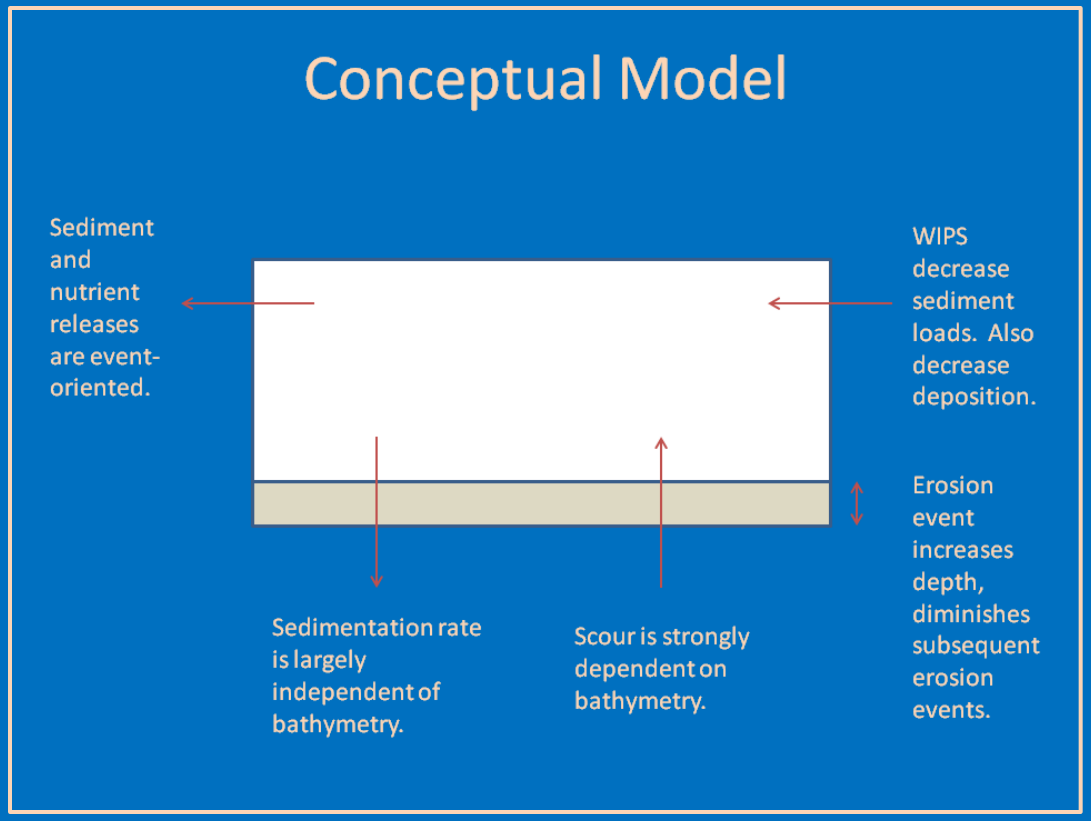
The Big Picture

- Model runs aimed at evaluating effect of Conowingo Reservoir filling are completed.
- Draft reports on ADH modeling of Conowingo, CBEMP modeling of Chesapeake Bay due October 2013.
- We are entering the scenario phase. Alternatives for managing sediment (removal, bypass, etc.) in Conowingo, watershed.

The Big Picture

- Dredging/bypass alternatives have been identified. Costs "scoped" for removal of 1 to 5 x 10^6 cubic yards.
- If you have ideas for sediment management, specific scenarios, now is the time to take them up with Project Management Team.
- Draft project report also due in October.

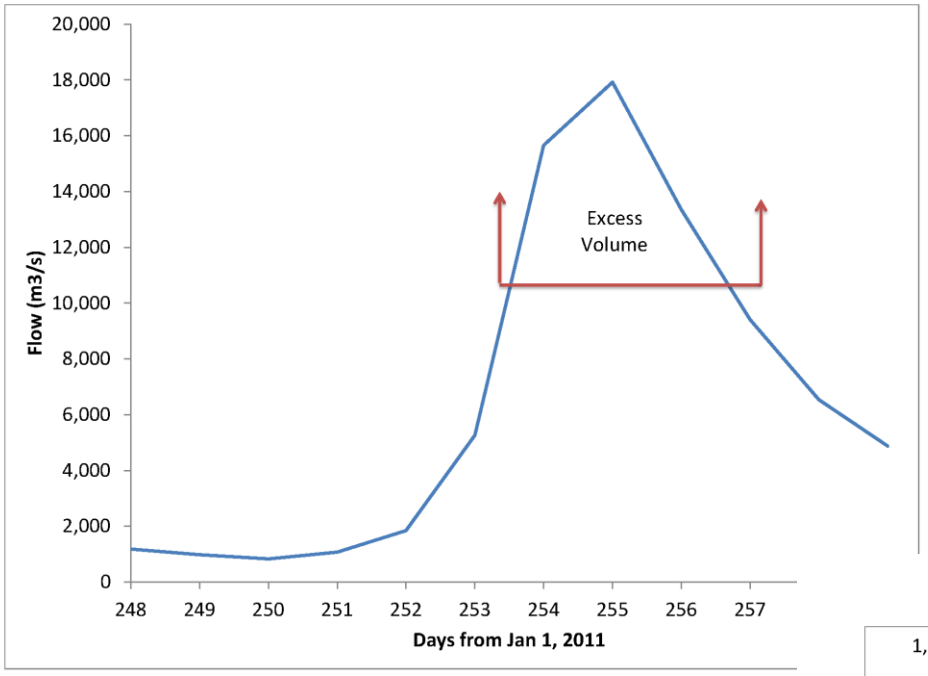
Conowingo Sedimentation



- This is an event-oriented system. Effects of sedimentation and bathymetry changes are most evident during scour events.
- Computations indicate little influence of bathymetry on solids discharge during non-storm periods.

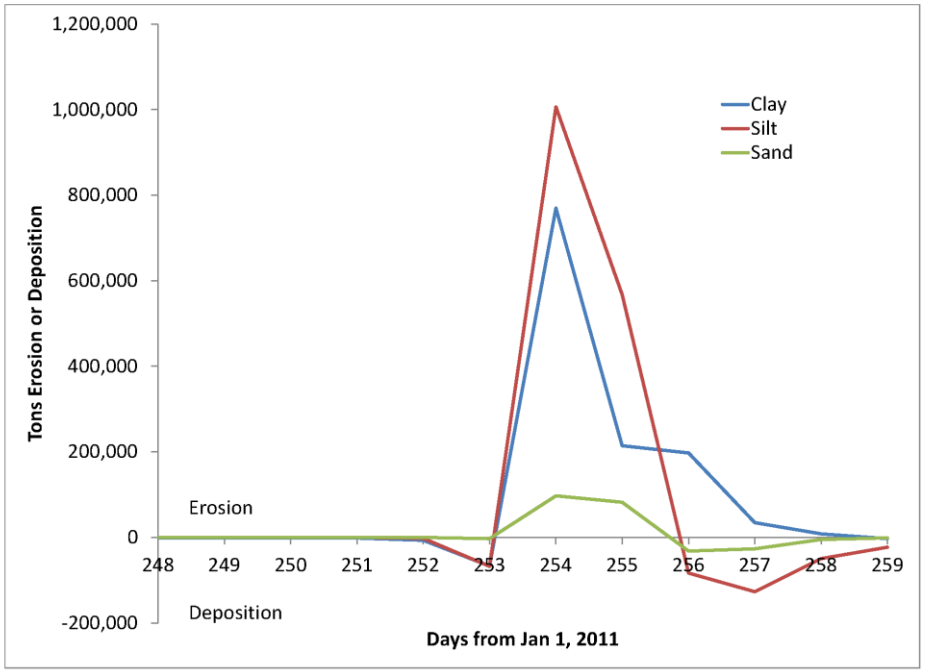
Computation of Scour Loads

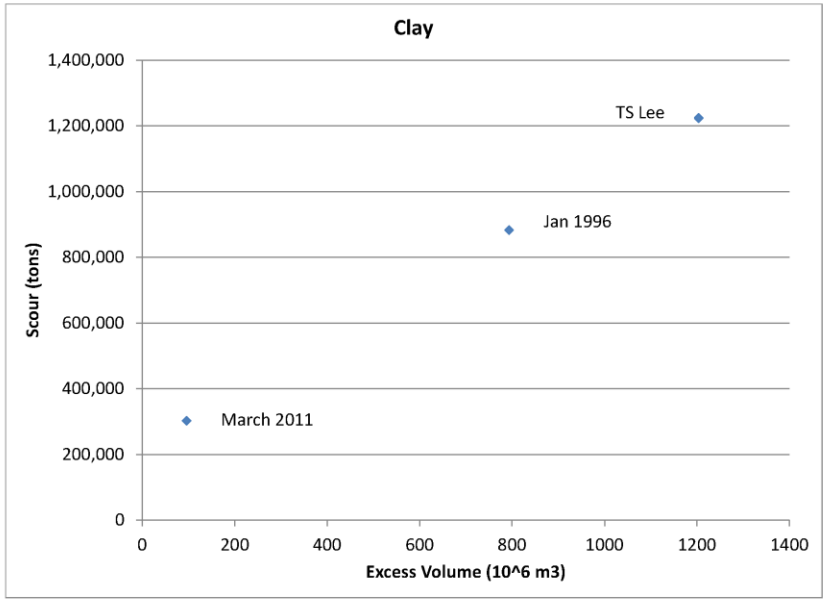
- ADH is the premier tool for computing sediment erosion, deposition, and transport in Conowingo Reservoir.
- The ADH application period, 2008 – 2011, contains two erosion events: Tropical Storm Lee and a small event in March 2011.
- We have three ADH runs based on alternate bathymetry:
  - Existing (2011) bathymetry,
  - Projected “Reservoir Full” bathymetry,
  - Bathymetry surveyed following 1996 scour event.
- ADH is not presently applied over our water quality simulation period, 1991 – 2000. We need a way to map computed erosion from 2011 to 1996.

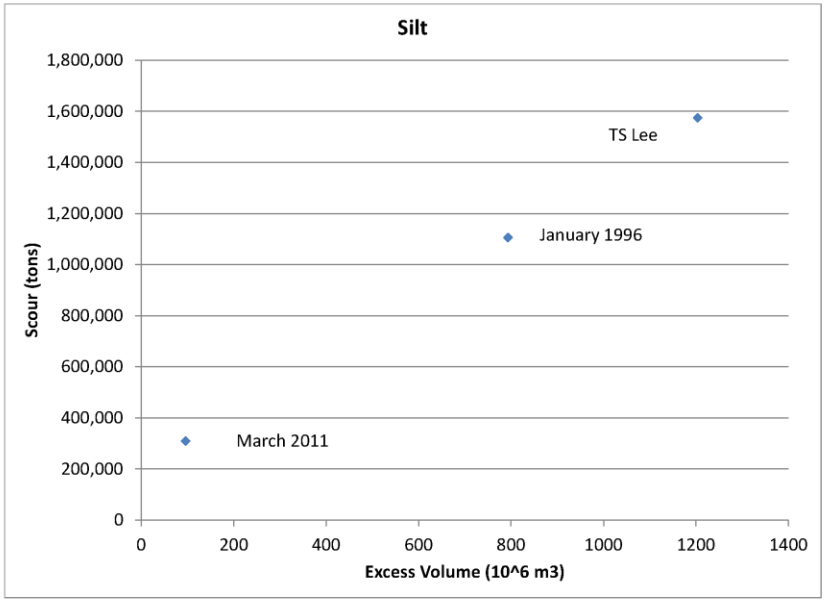


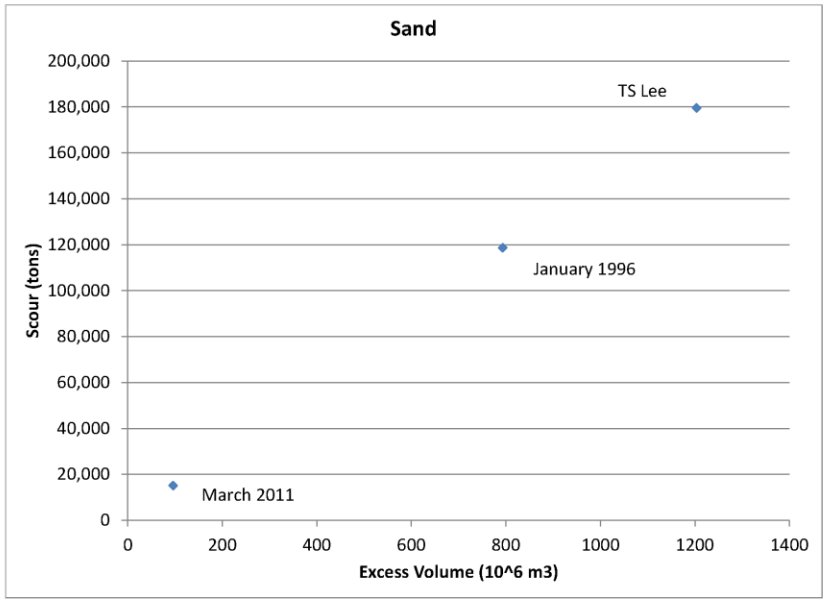
The greatest flow during TS Lee occurs on Day 255, the second day on which flow exceeds the criteria for scour: 11,000 m^3/s.

The greatest scour occurs on Day 254, the first day on which flow exceeds 11,000 m^3/s. After that, the bed armors.

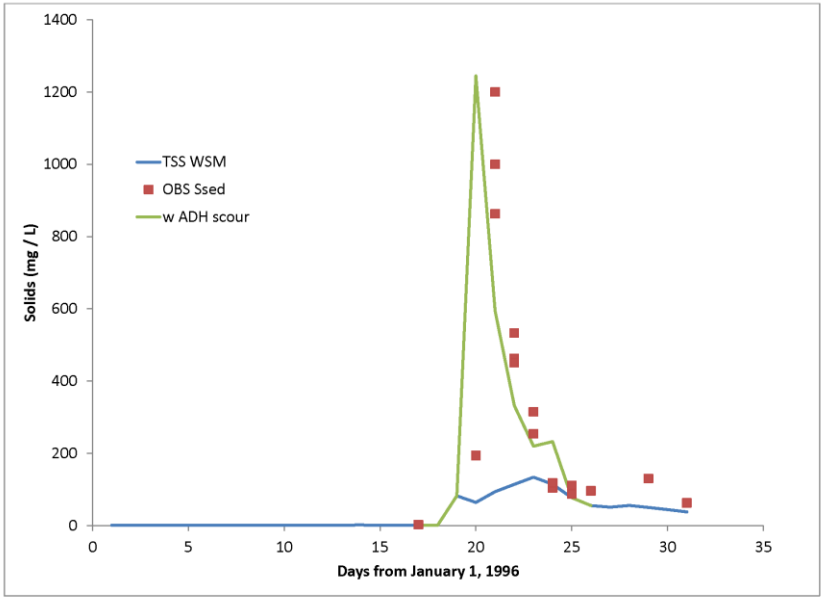


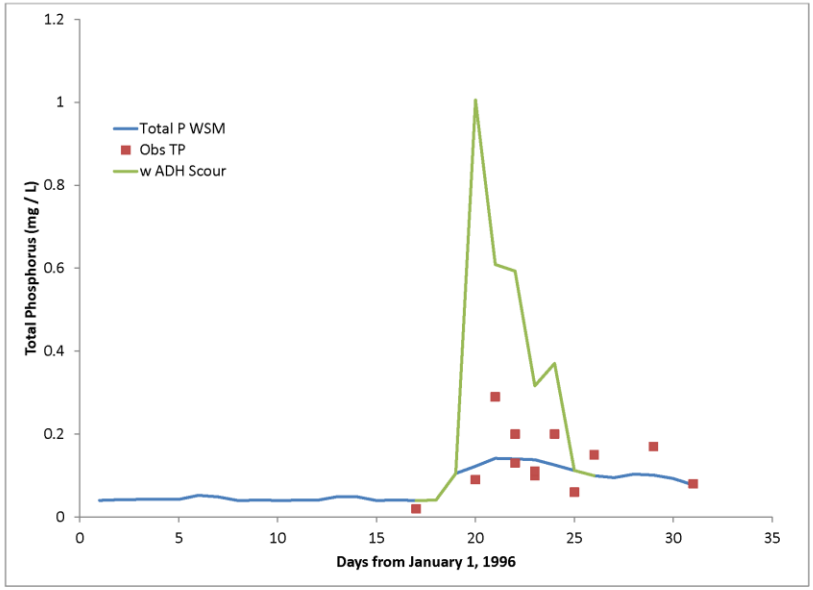


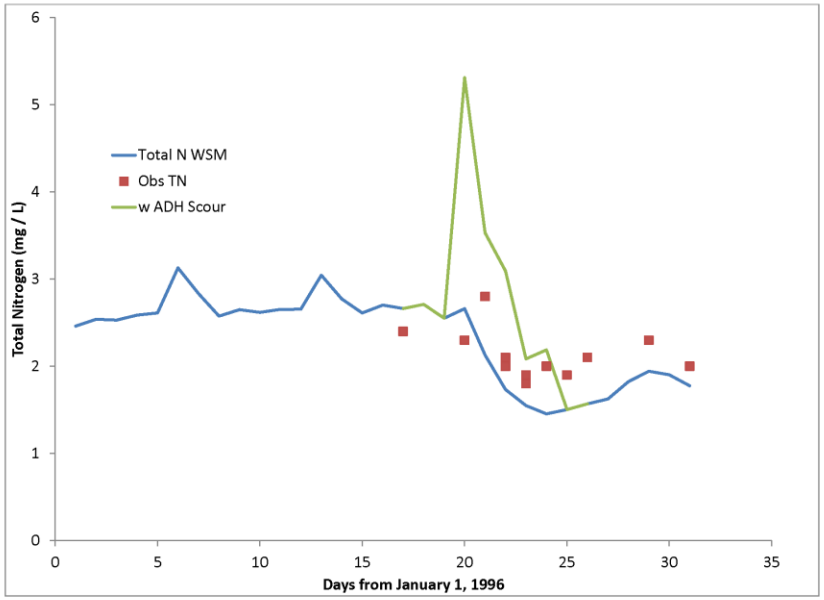




- Solids loads for January 1996 are based on excess volume. Interpolate between two events calculated for 2011.
- Initial nutrient and carbon loads based on bottom composition: 5% C, 0.3% N, 0.1%P.
- Add the scour loads to the WSM loads. No other adjustment to the WSM loads.

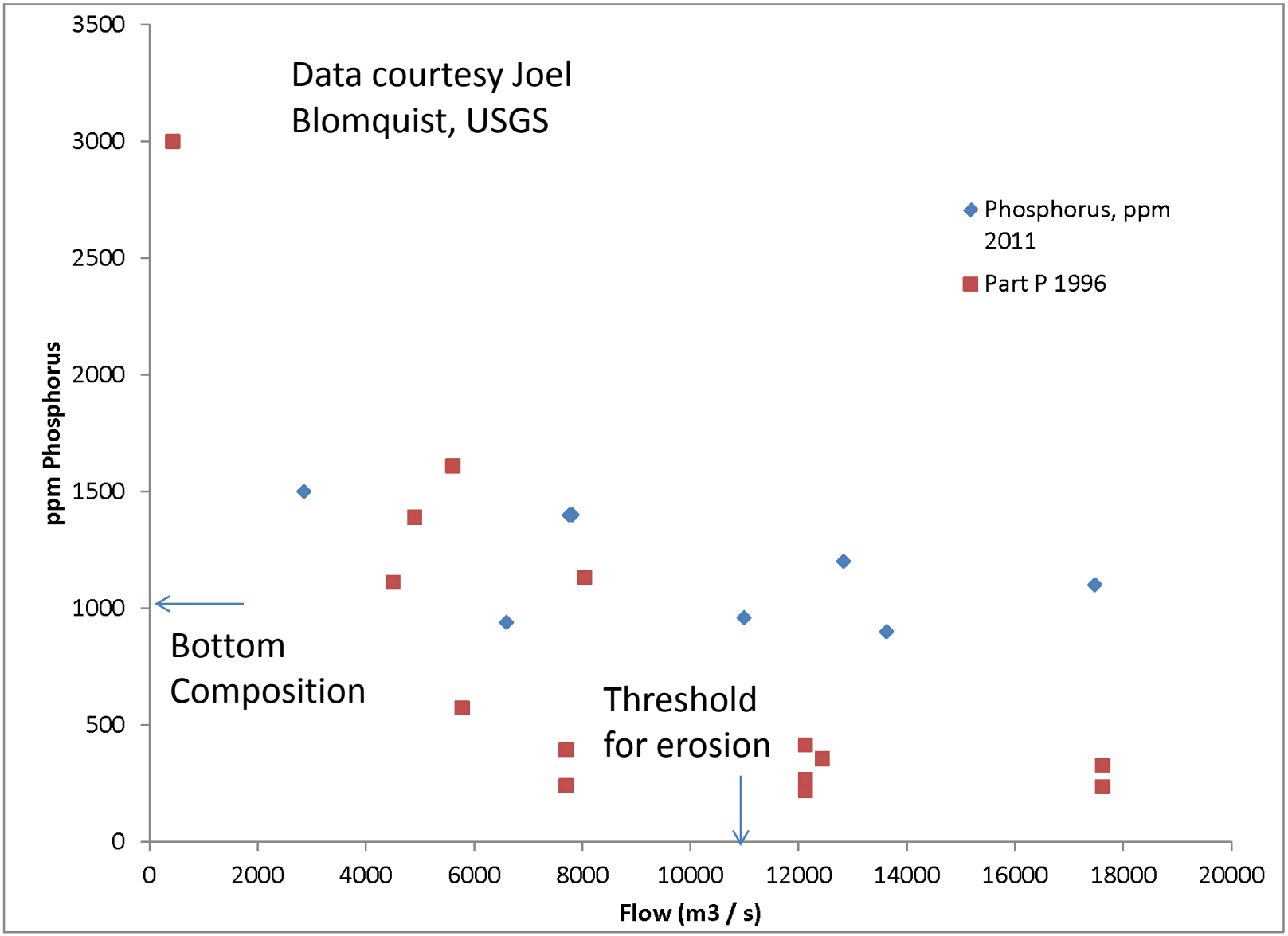




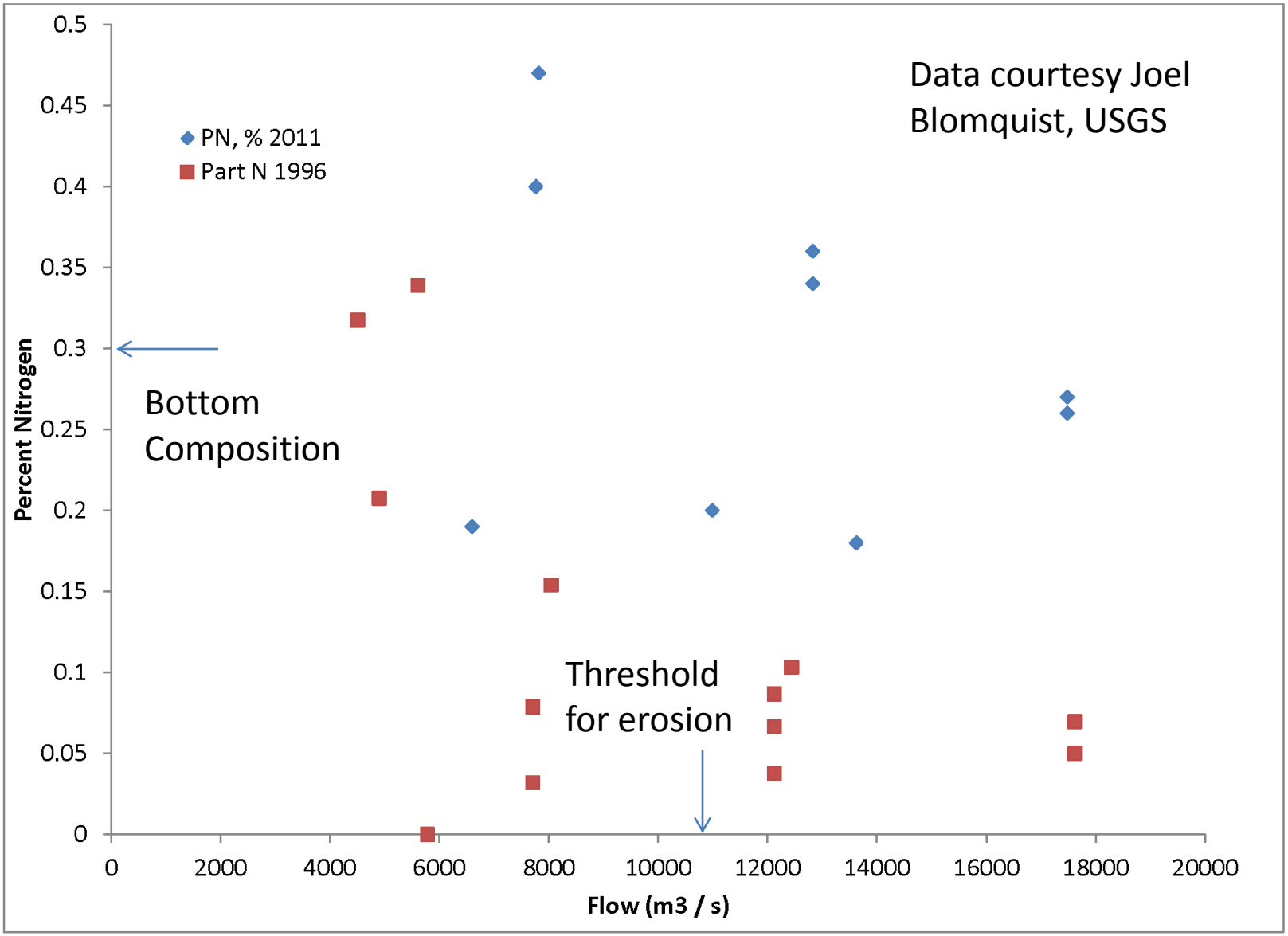


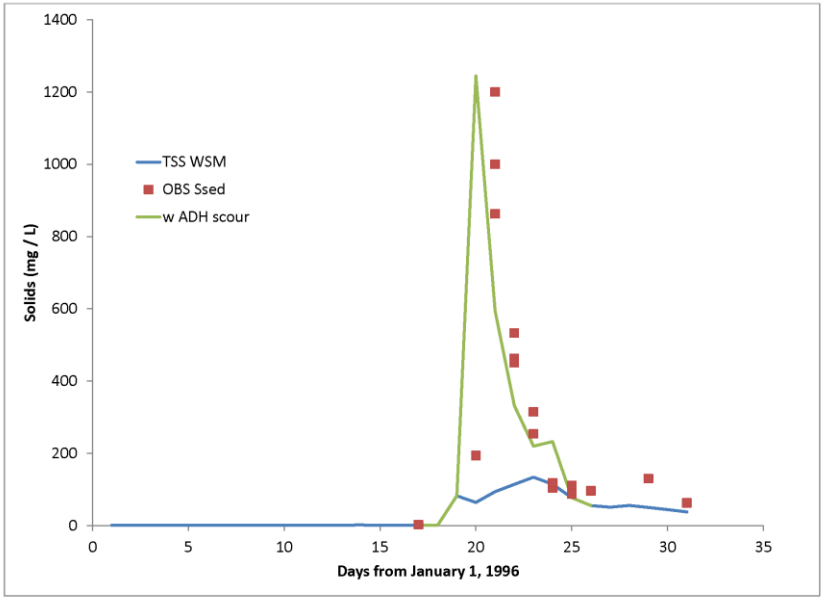
- Solids and nutrient concentrations.
- Scour based on ADH calculation.
- Particle composition based on observed bottom composition.

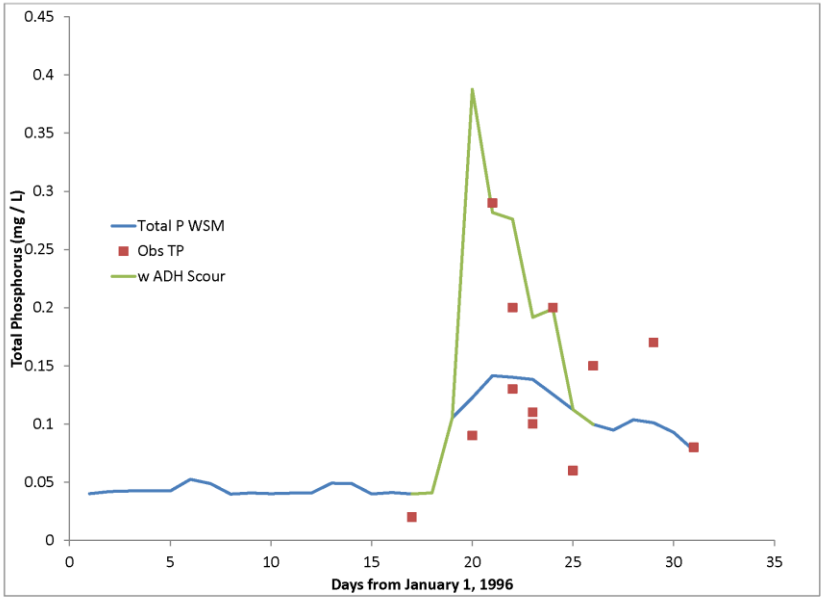
PARTICLE COMPOSITION

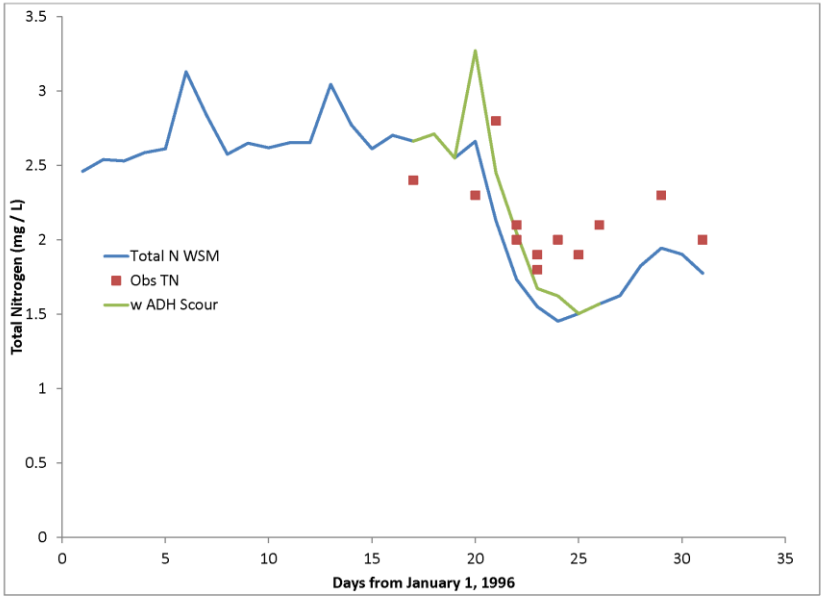


PARTICLE COMPOSITION









- Solids and nutrient concentrations.
- Scour based on ADH calculation.
- Particle composition based on observed 1996 properties of particles flowing over dam.

Dilemma

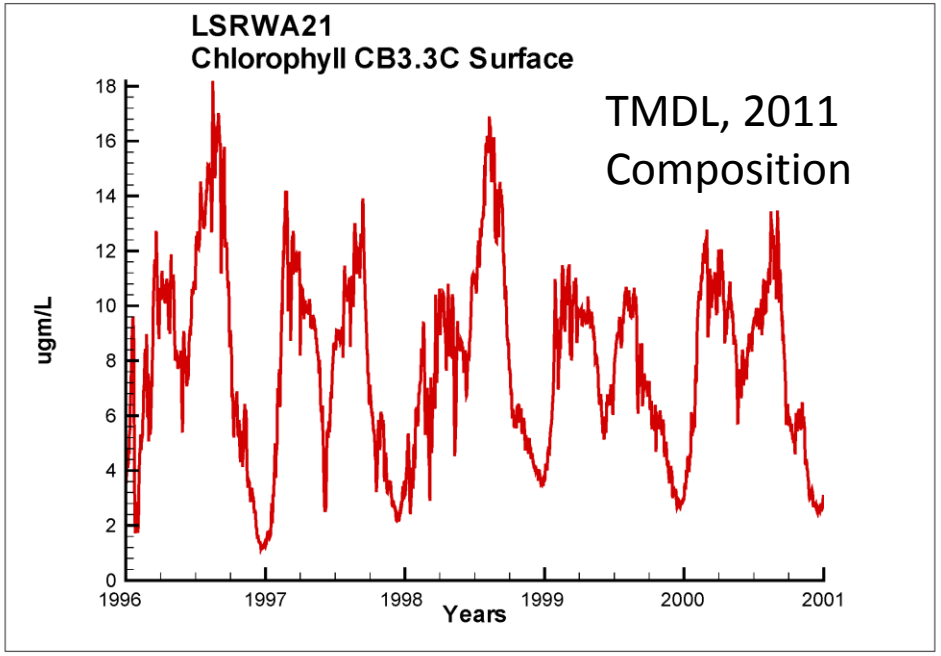
- Particle composition (nutrient content) differs between 1996 and 2011.
- 2011 composition at flows sufficient to cause scour reflects composition of bottom sediments.
- 1996 composition is nutrient deficient relative to bottom sediments, 2011.
- No explanation except 1996 storm was different than 2011 (season, origin, hydrology).

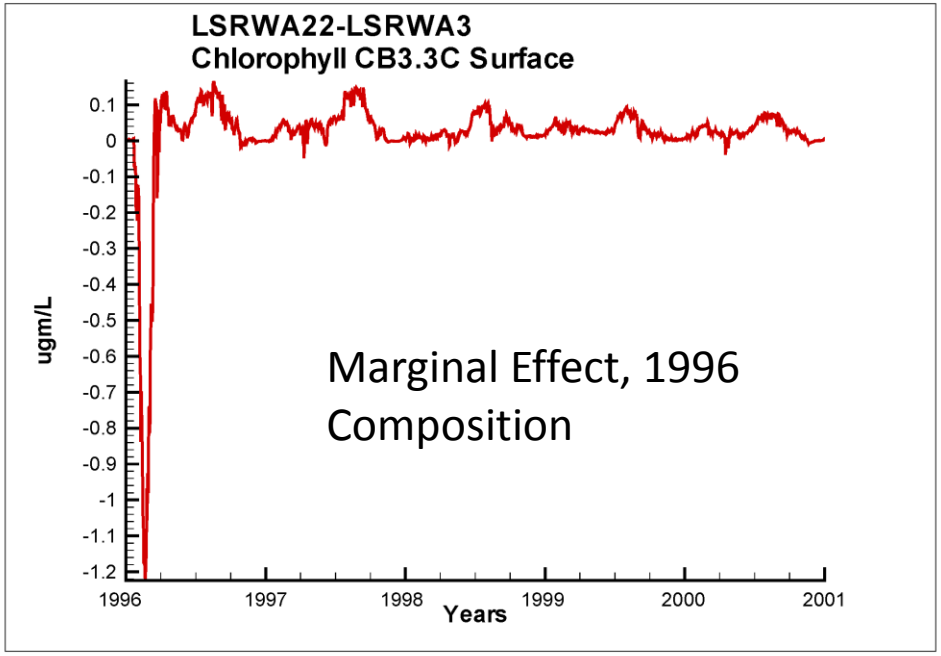
Dilemma

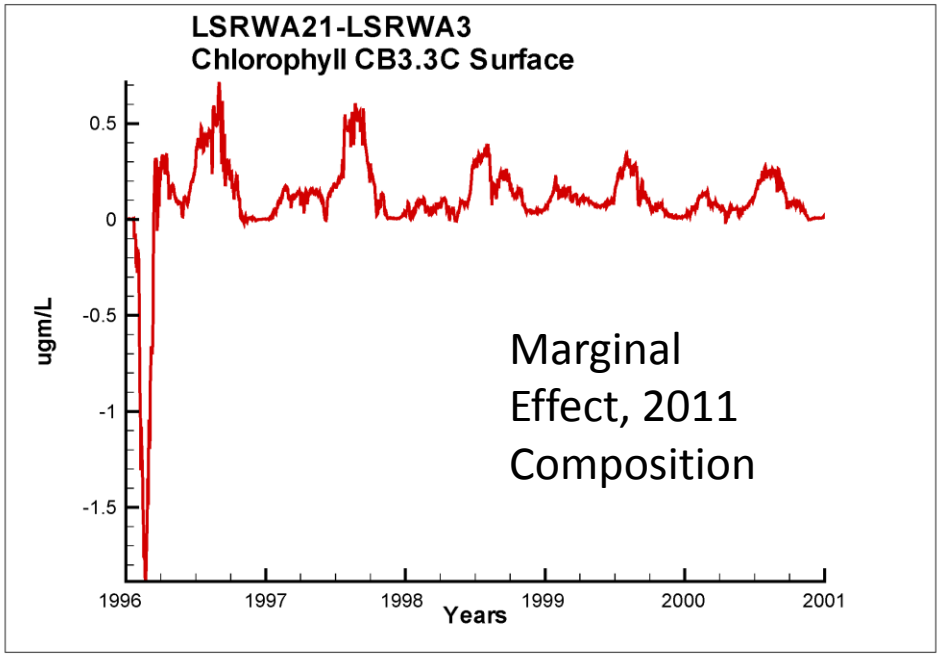
- We have to accept that the observed 1996 particle composition reflects the 1996 event.
- What do we do for scenarios? Use 1996 observations or more recent 2011 observations?
- The 2011, Tropical Storm Lee, observations are likely more representative of conditions of the typical storm which results in major erosion events.

Dilemma

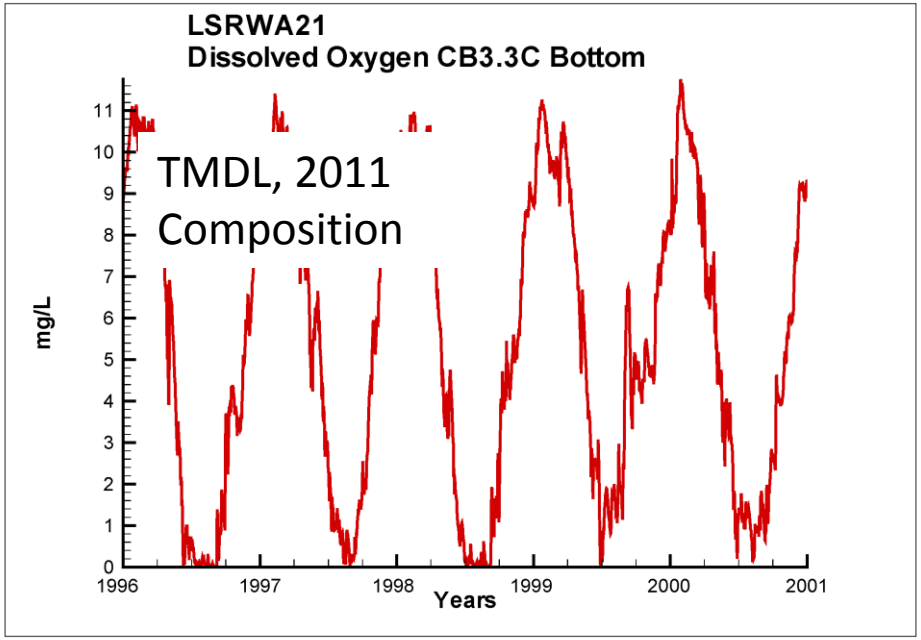
- Most of our runs to date have used 2011 composition.
- We have re-run key scenarios using 1996 composition.
- Differences are small but important.

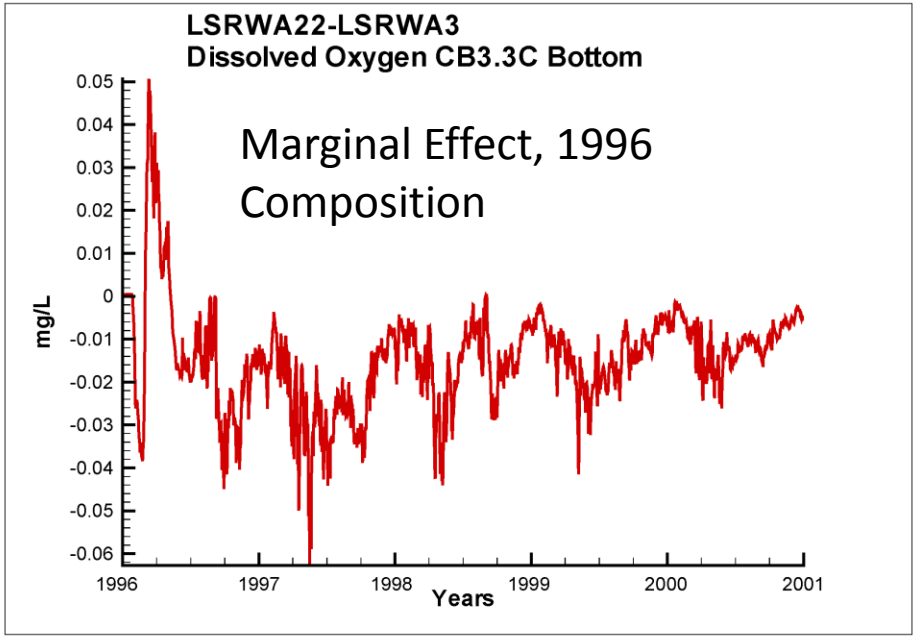


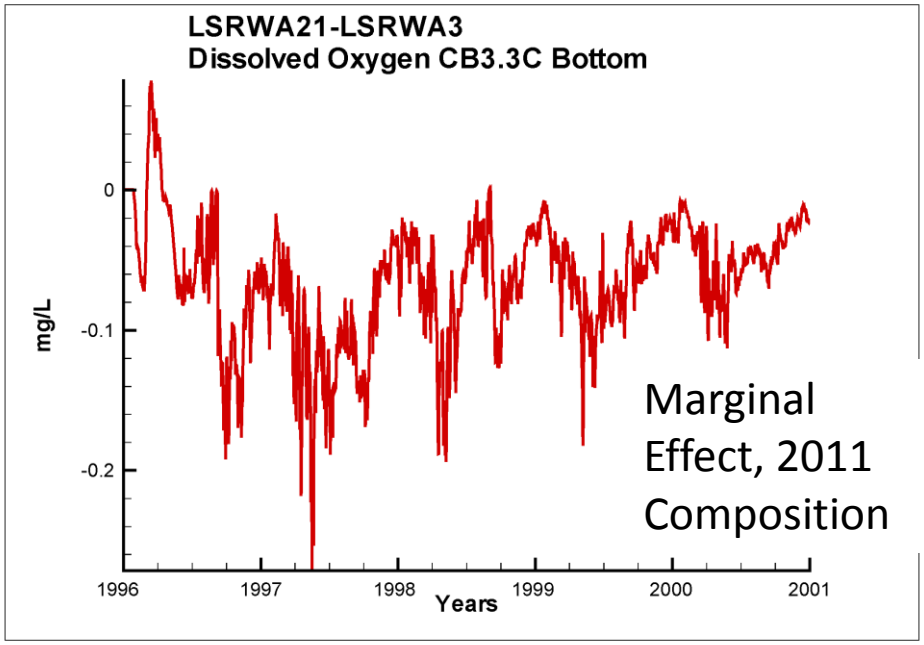




The marginal effect of a scour event using 1996 composition is about half the effect using 2011 composition.







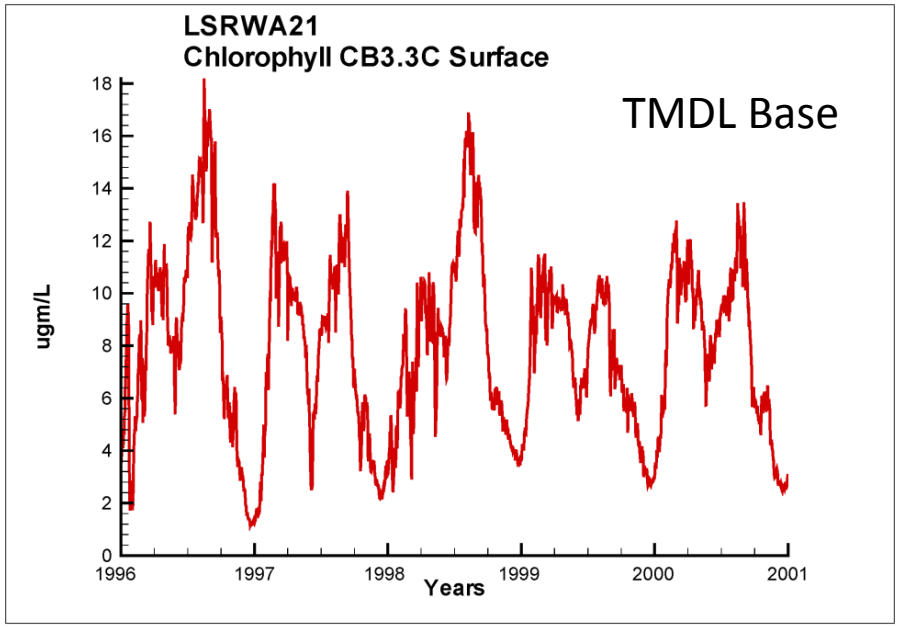
The marginal effect of a scour event using 1996 composition is about half the effect using 2011 composition.

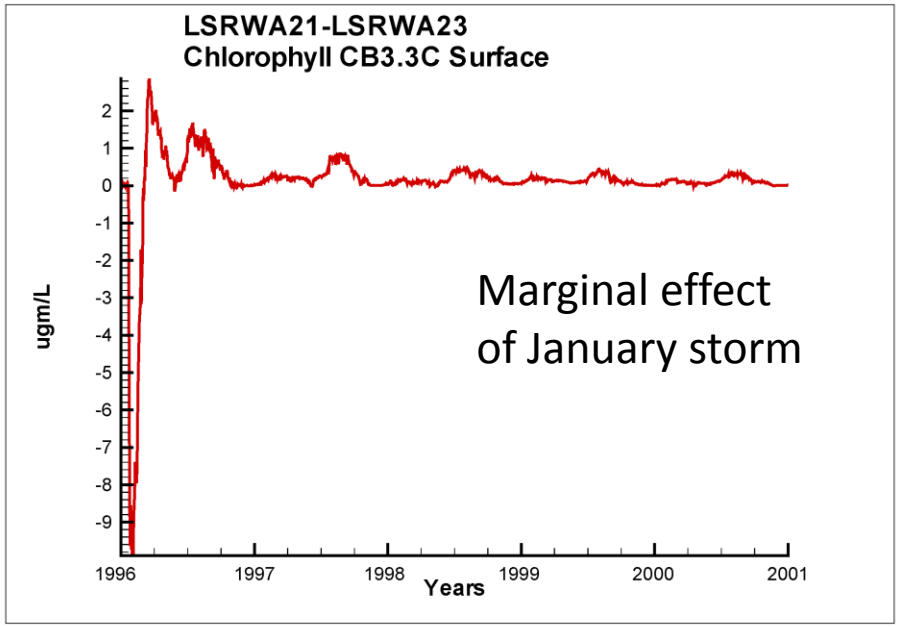
Let's Switch Gears

- We have been examining the effect of an erosion event. What about the timing of the event?
- EPA CBP has produced hydrodynamics and WSM runs that move the 1996 storm to different months.

Timing of Storm Event

- The following runs have been completed in addition to runs with ADH-based scour from the January 1996 storm:
  - No winter storm
  - Storm moved to June
  - Storm moved to October
- These runs examine the effect of the entire event including runoff and scour!


LSRWA21
Chlorophyll CB3.3C Surface
TMDL Base
ugm/L
Years
1996
1997
1998
1999
2000
2001


LSRWA21-LSRWA23
Chlorophyll CB3.3C Surface
Marginal effect
of January storm
ugm/L
Years
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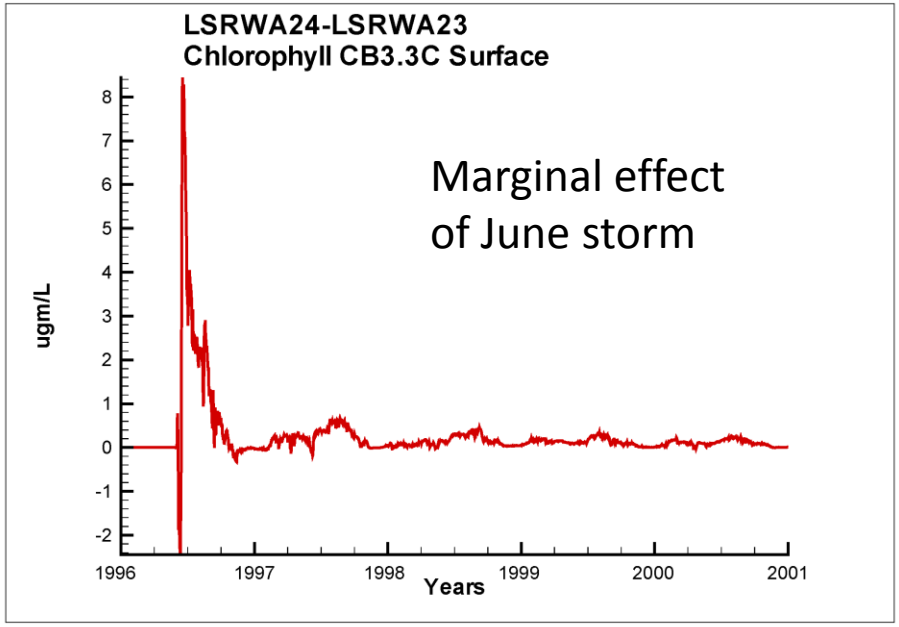
LSRWA24-LSRWA23
Chlorophyll CB3.3C Surface
Marginal effect
of June storm
ugm/L
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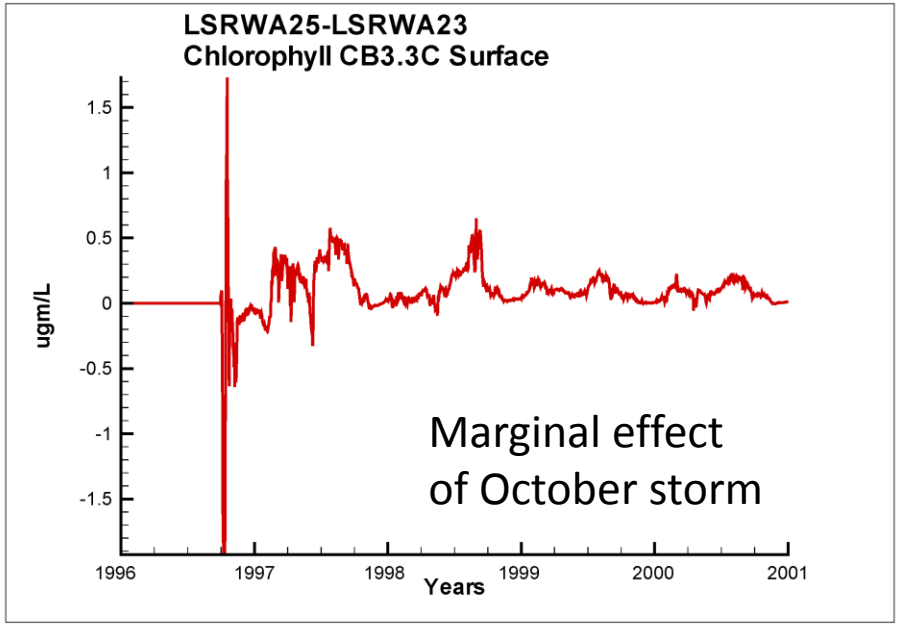
LSRWA25-LSRWA23
Chlorophyll CB3.3C Surface
Marginal effect
of October storm
ugm/L
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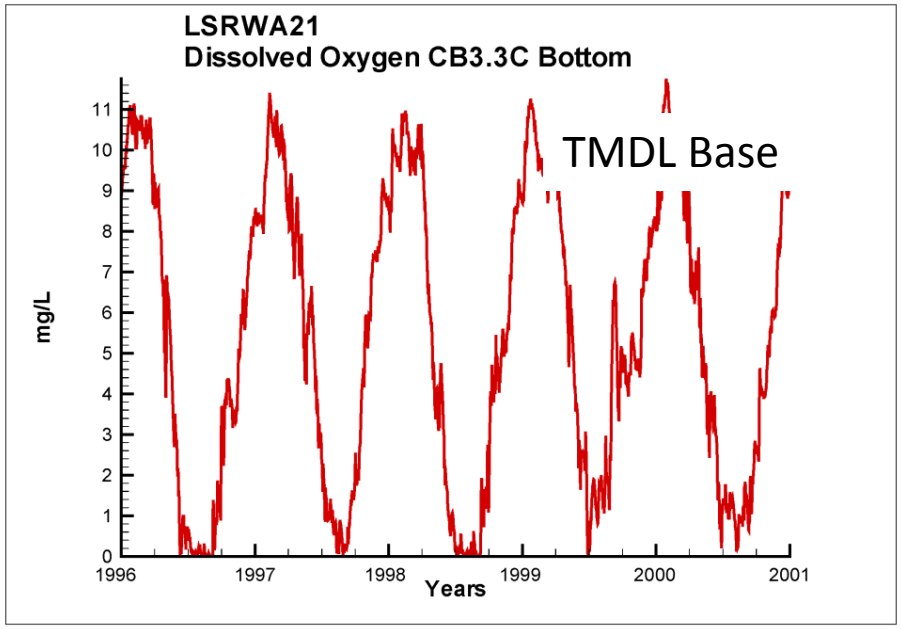
LSRWA21
Dissolved Oxygen CB3.3C Bottom
TMDL Base
mg/L
Years
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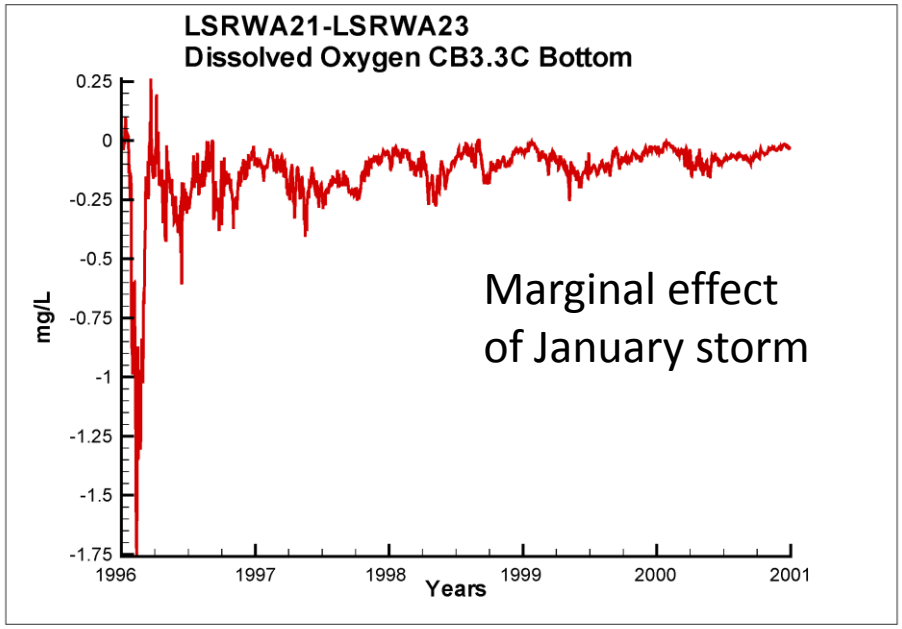
2001


LSRWA21-LSRWA23
Dissolved Oxygen CB3.3C Bottom
Marginal effect
of January storm
mg/L
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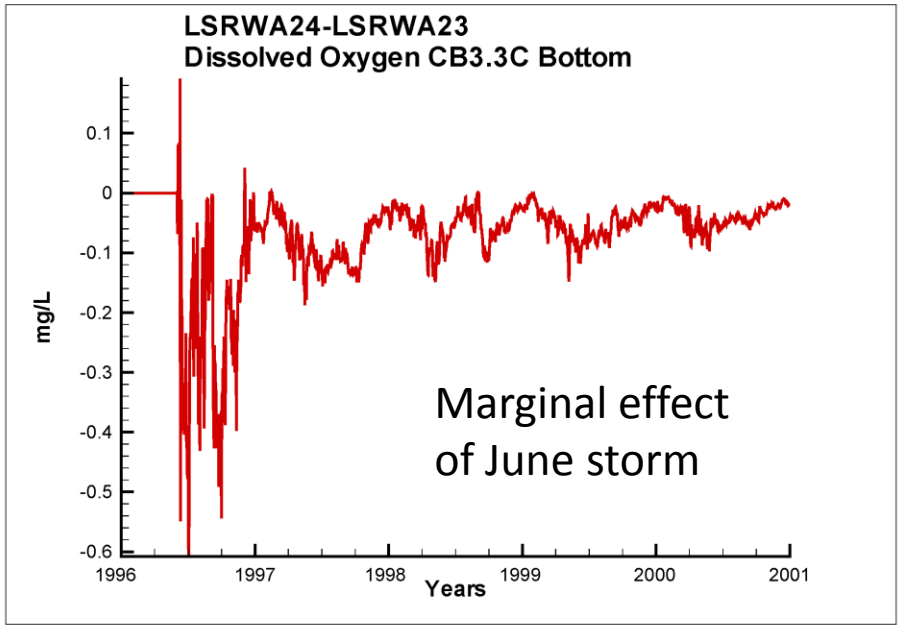
LSRWA24-LSRWA23
Dissolved Oxygen CB3.3C Bottom
Marginal effect
of June storm
mg/L
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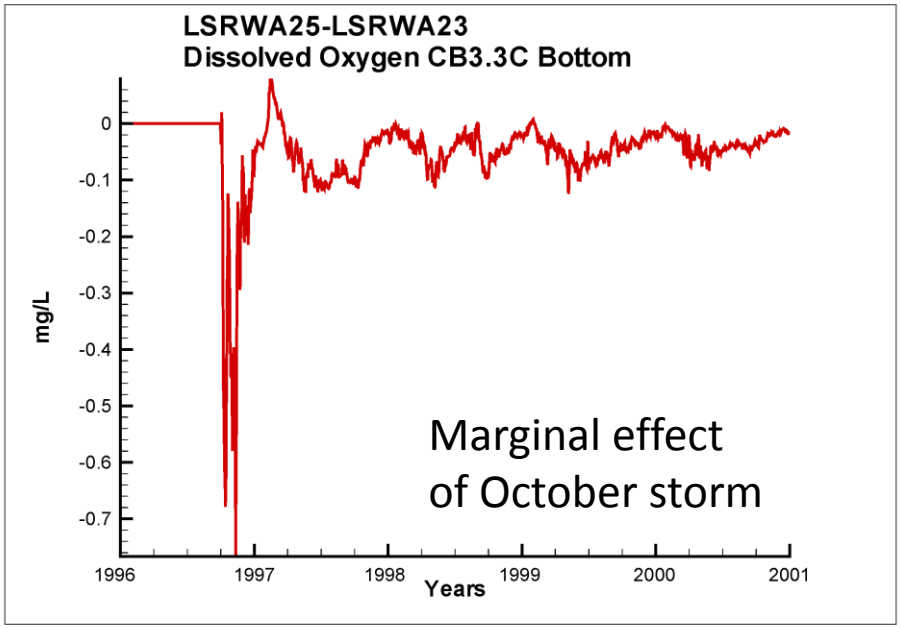
LSRWA25-LSRWA23
Dissolved Oxygen CB3.3C Bottom
Marginal effect
of October storm
mg/L
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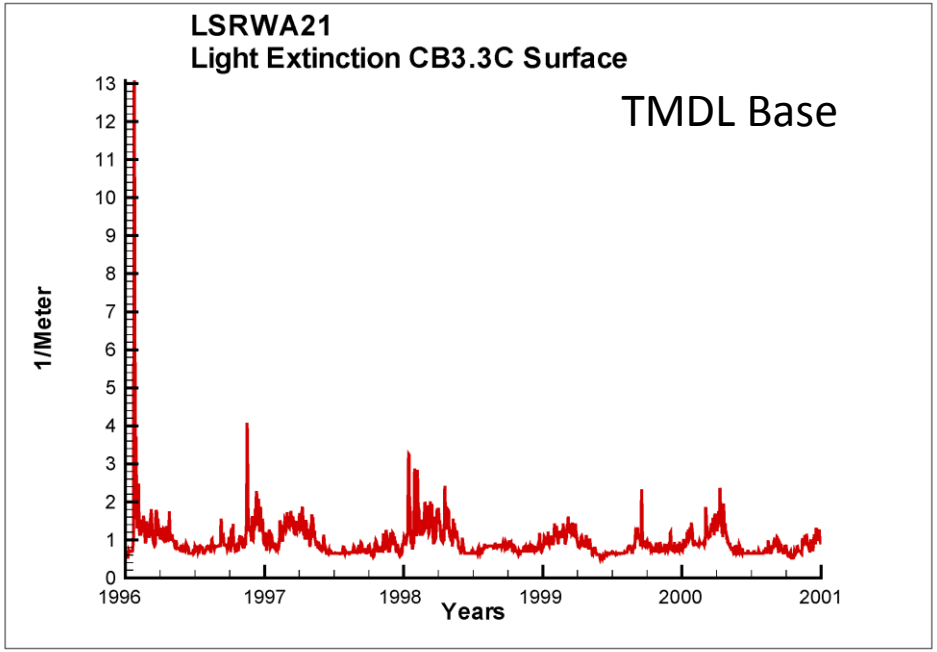
LSRWA21
Light Extinction CB3.3C Surface
TMDL Base
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Years
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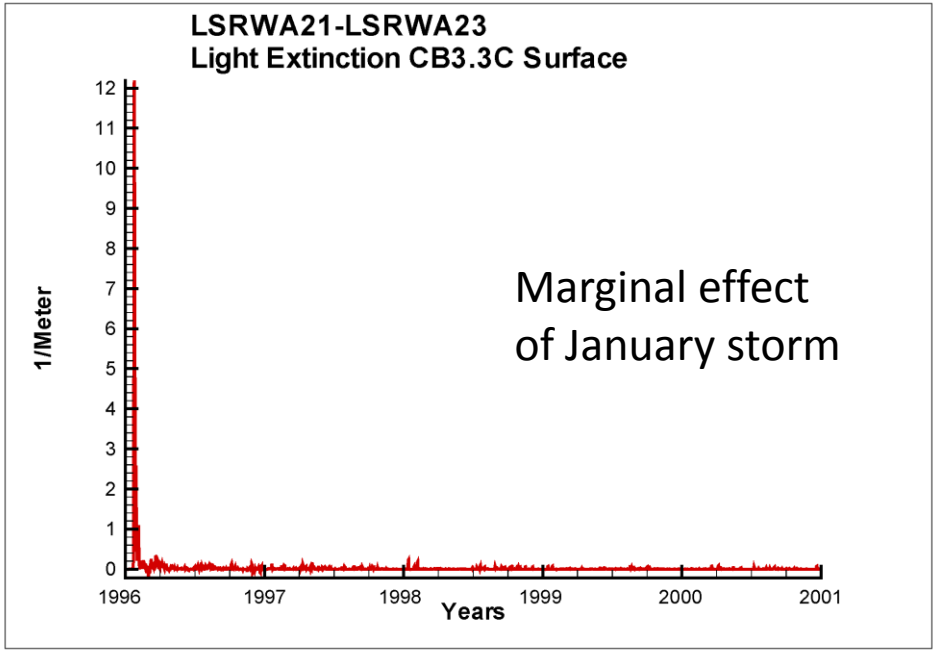
LSRWA21-LSRWA23
Light Extinction CB3.3C Surface
Marginal effect
of January storm
1/Meter
Years
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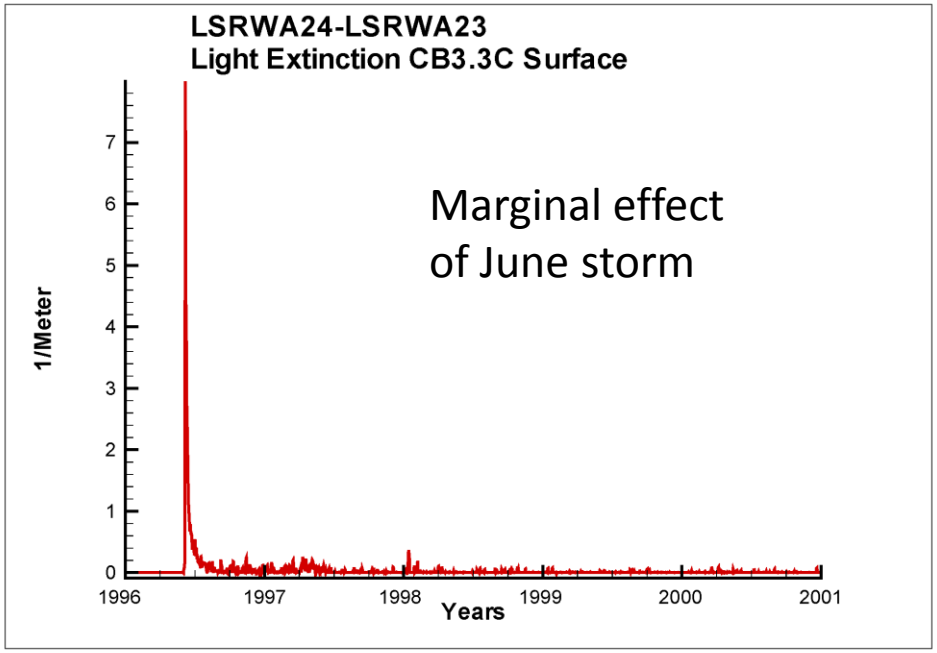
LSRWA24-LSRWA23
Light Extinction CB3.3C Surface
Marginal effect
of June storm
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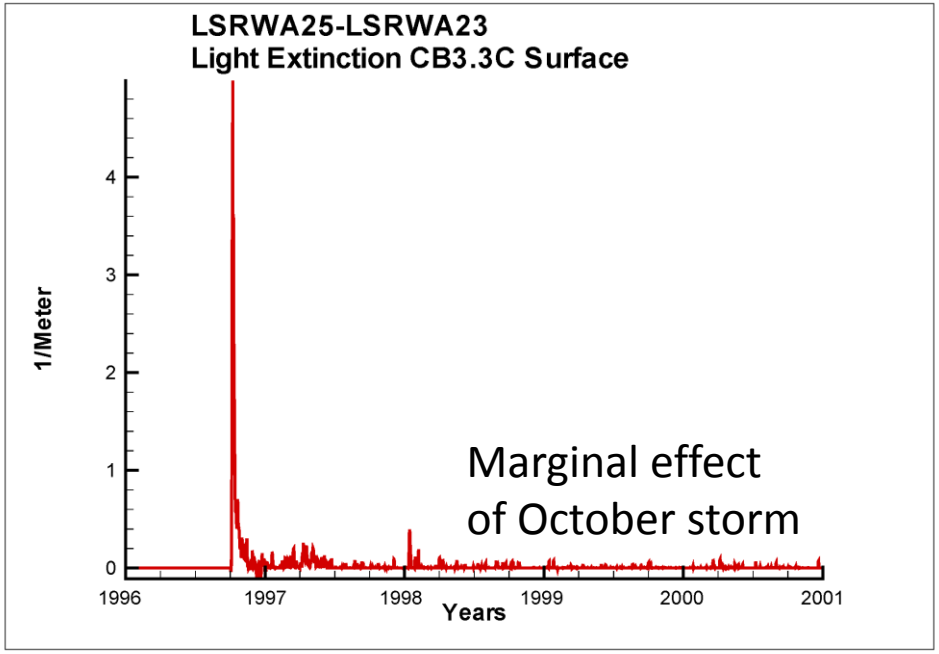
LSRWA25-LSRWA23
Light Extinction CB3.3C Surface
Marginal effect
of October storm
1/Meter
Years
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1996
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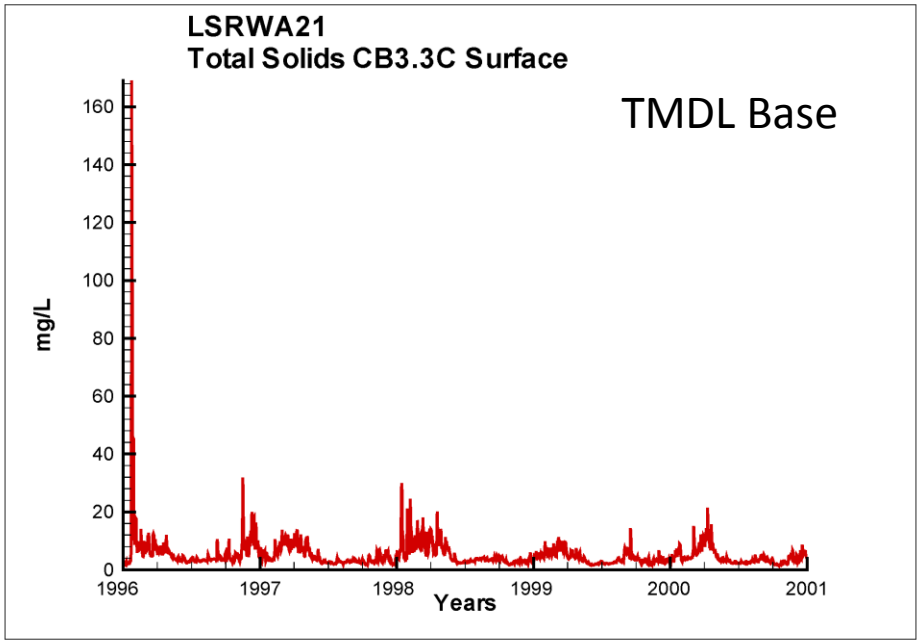
LSRWA21
Total Solids CB3.3C Surface
TMDL Base
mg/L
0
20
40
60
80
100
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140
160
1996
1997
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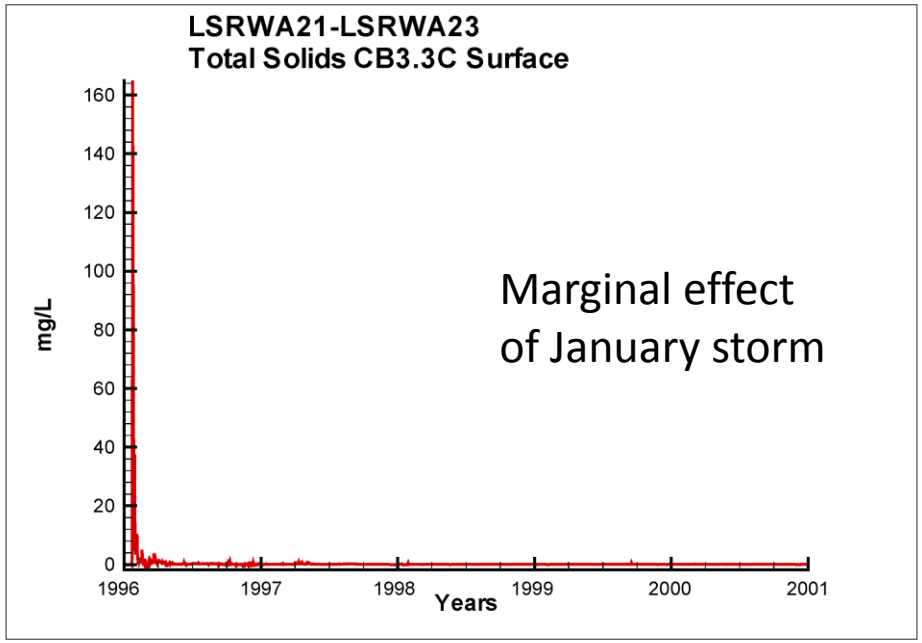
2001
Years


LSRWA21-LSRWA23
Total Solids CB3.3C Surface
Marginal effect
of January storm
mg/L
0
20
40
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160
1996
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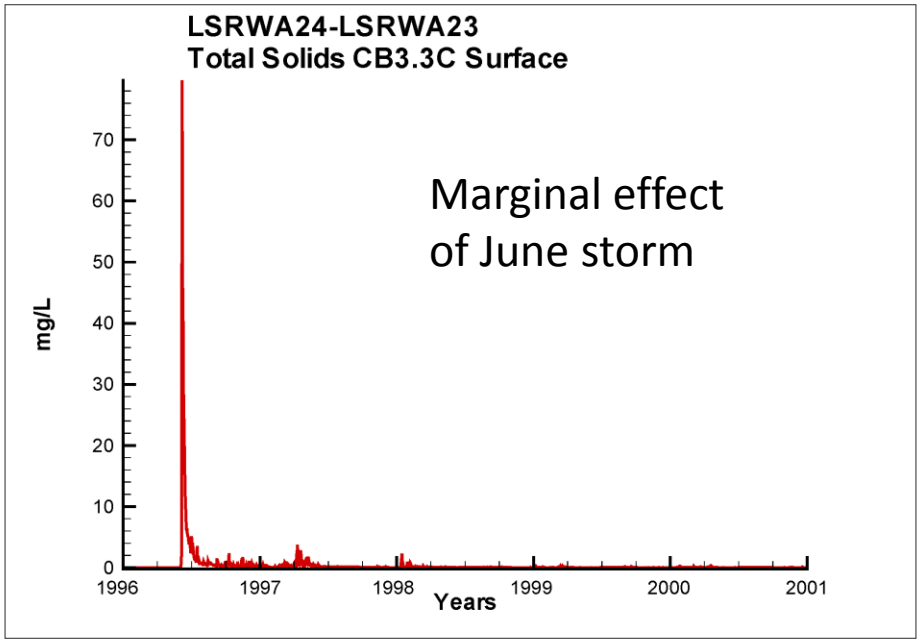
Years


LSRWA24-LSRWA23
Total Solids CB3.3C Surface
Marginal effect
of June storm
mg/L
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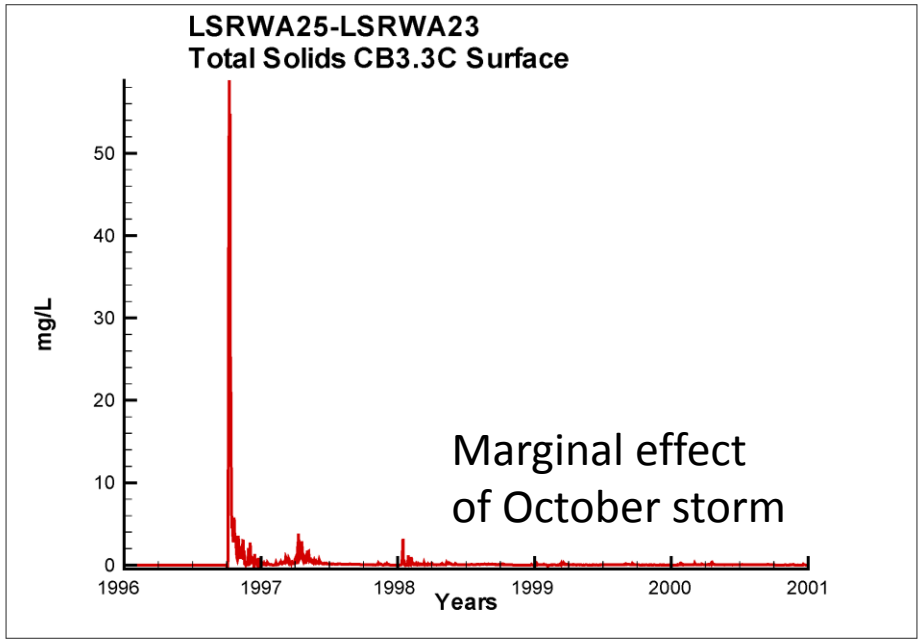
Years


LSRWA25-LSRWA23
Total Solids CB3.3C Surface
Marginal effect
of October storm
mg/L
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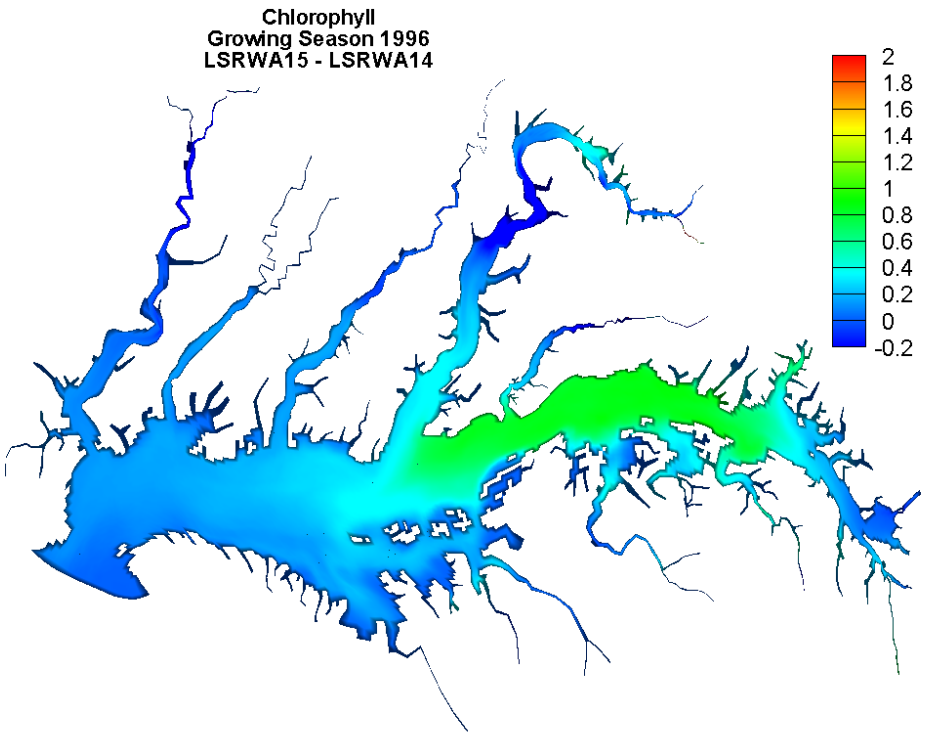
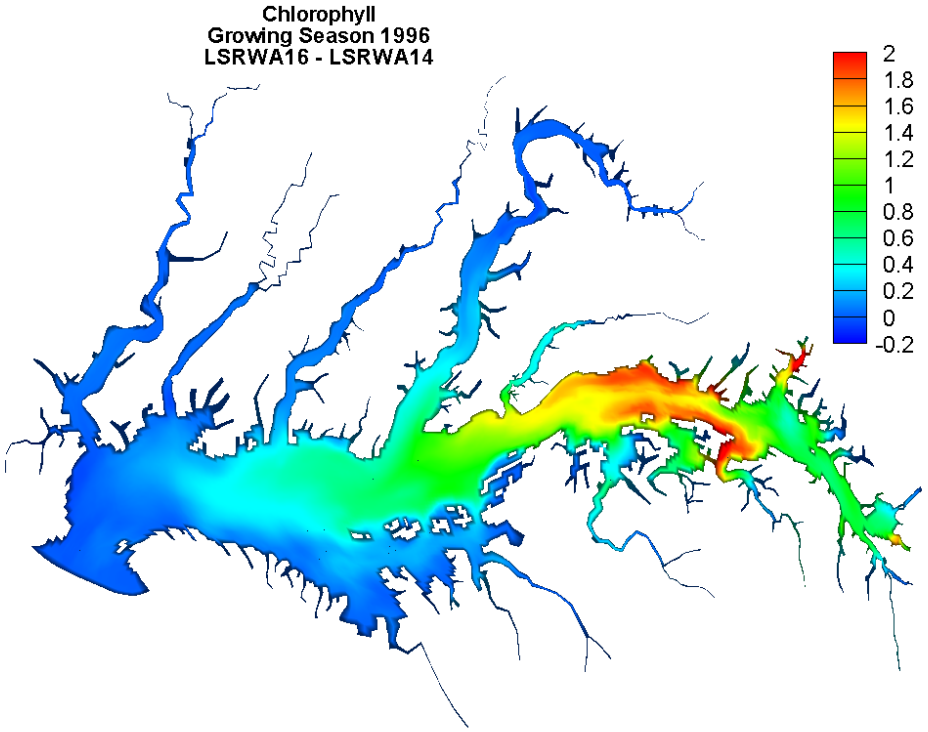
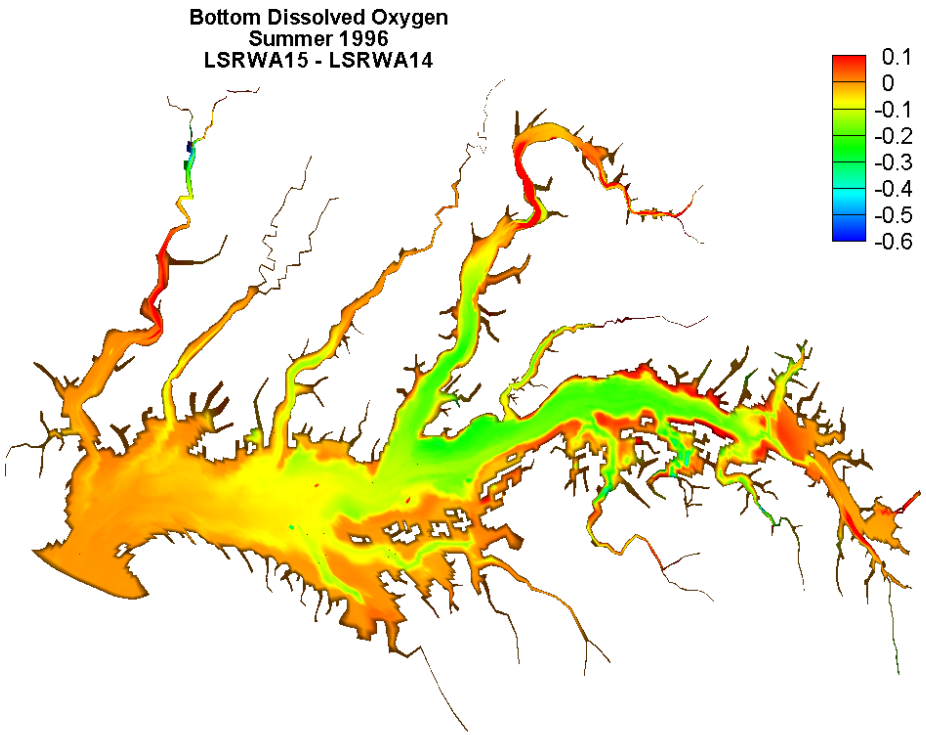
Years



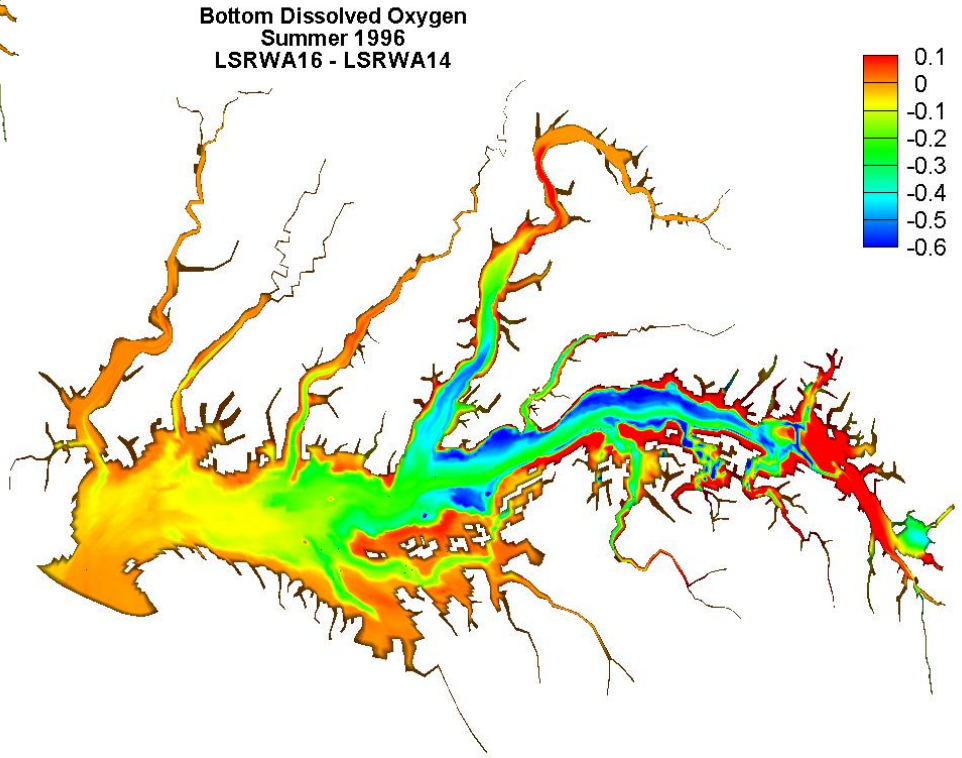
Marginal Effect of January Storm

Marginal Effect of June Storm

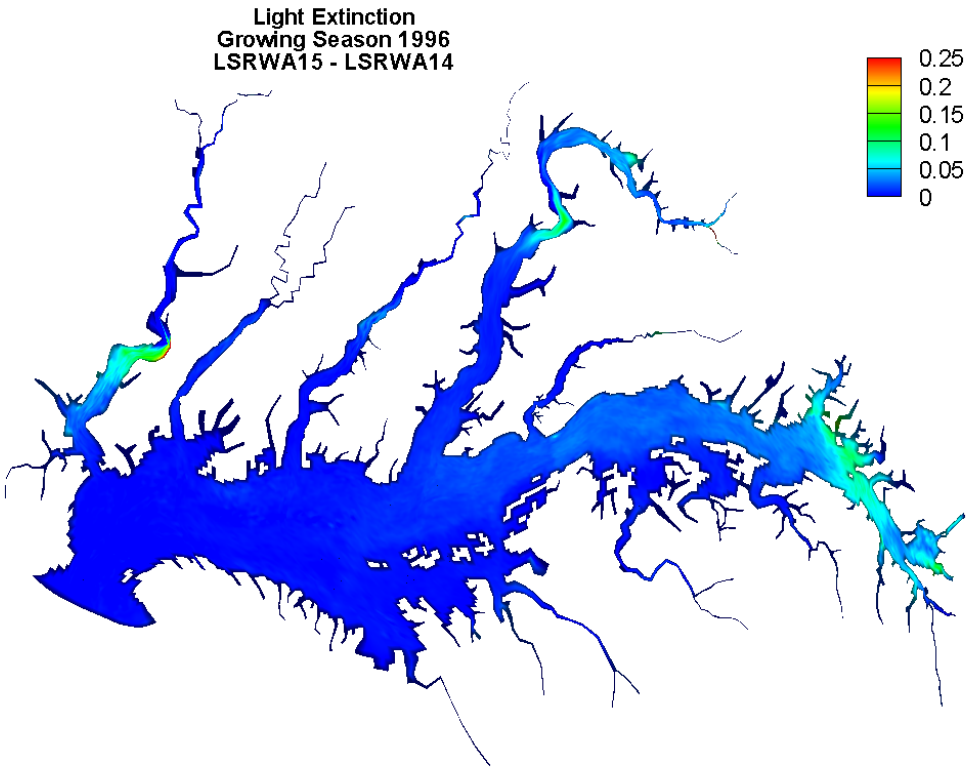




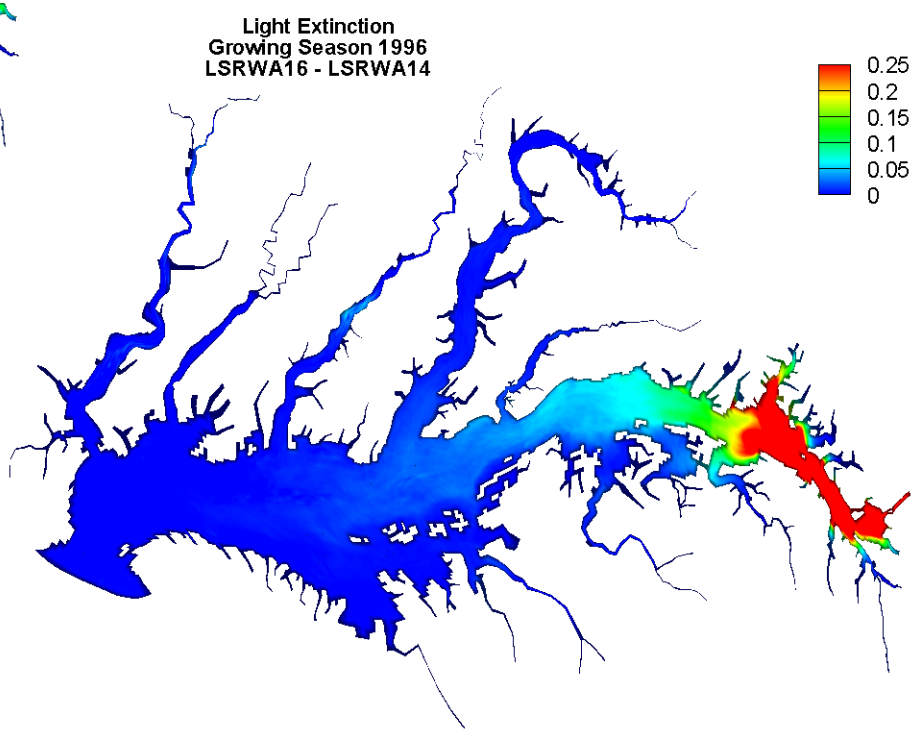
Marginal Effect of January Storm



Marginal Effect of June Storm

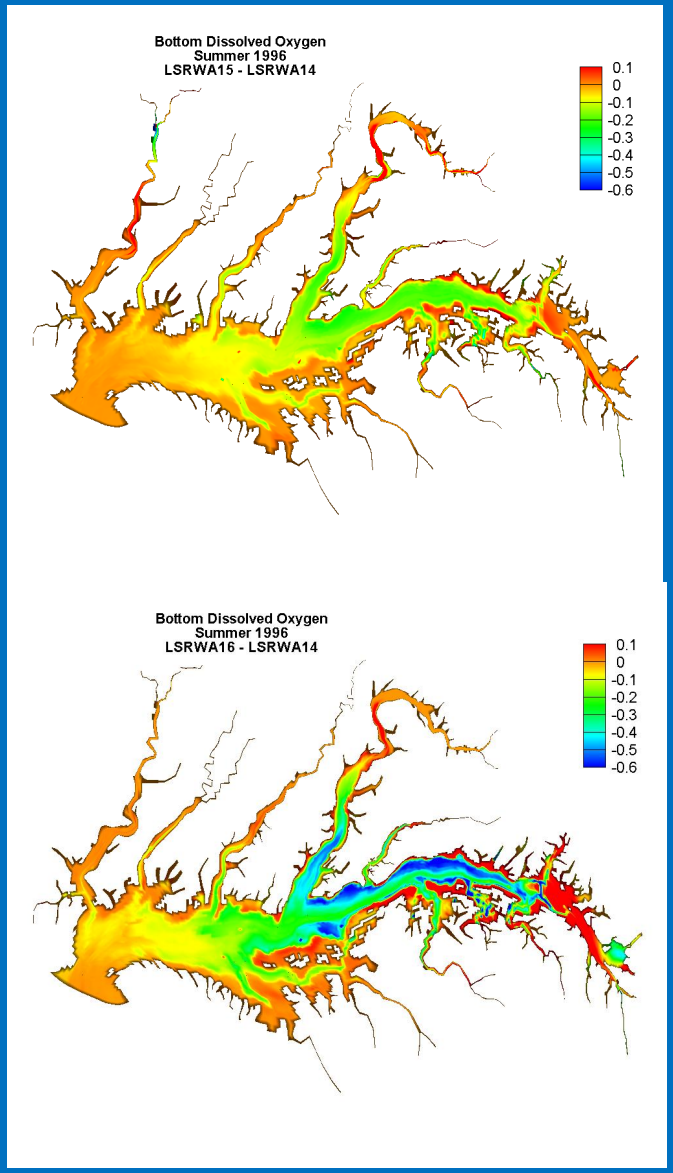


Marginal Effect of January Storm



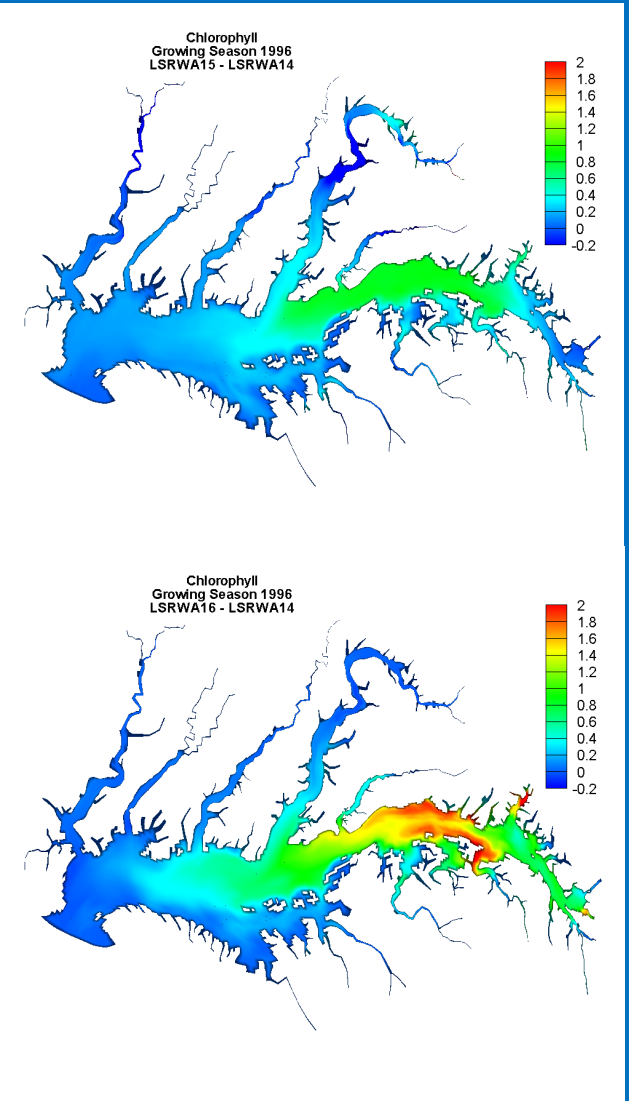
Marginal Effect of June Storm

Storm Events



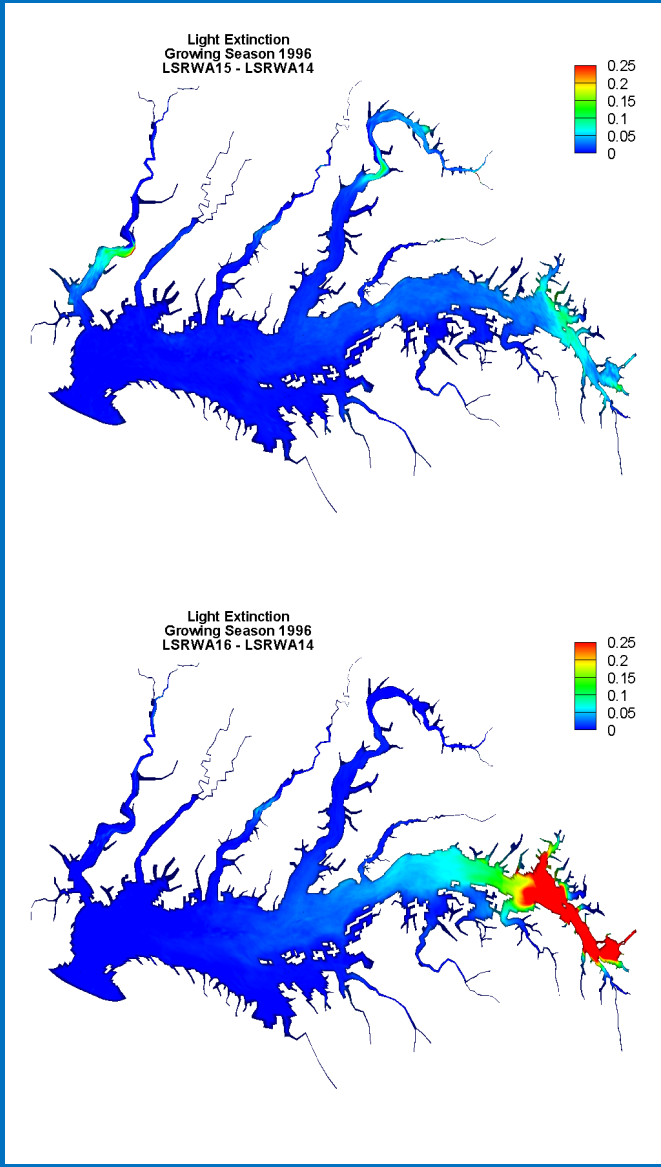
- The impact of storm events originates with two sources: the watershed and, potentially, scour.
- Timing is important. The "best" time for a storm is late fall or early winter. The worst time is early summer.
- A winter storm depresses summer-average DO by ≈ 0.3 mg/L. An early summer storm depresses summer-average DO by ≈ 0.6 mg/L.

Storm Events



- A winter storm increases SAV growing season average Chl by ≈ 1 µg/L.
- An early summer storm increases SAV growing season average Chl by ≈ 2 µg/L. .

Storm Events



- A winter storm increases SAV growing season average KE by ≈ 0.1 /m.
- An early summer storm increases SAV growing season average Chl by ≈ 0.25 /m.