Three Focus Activities

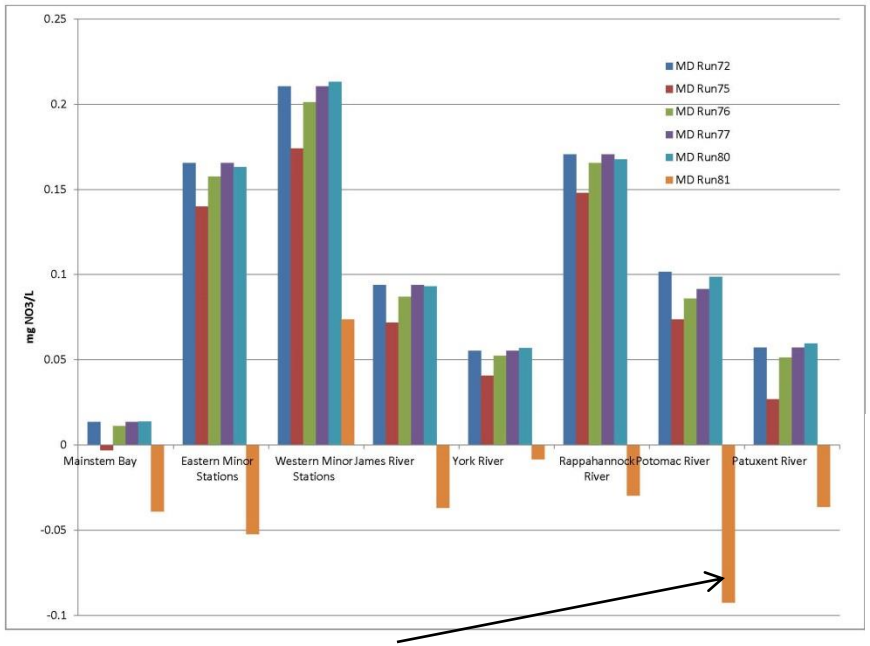
- Wetlands
- CH3D revisions
- General Calibration Adjustments

Phase 6 Watershed Model

- The Phase 6 WSM delivers more nitrogen (NO3) than previous WSM versions.
- Model sensitivity runs to reduce excess NO3:
  - Adjust algal preference to use more NO3 versus NH4
  - Increase sediment denitrification in freshwater regions
  - Increase algal settling and predation
  - Increase settling of particulate nitrogen
  - Introduce wetland denitrification

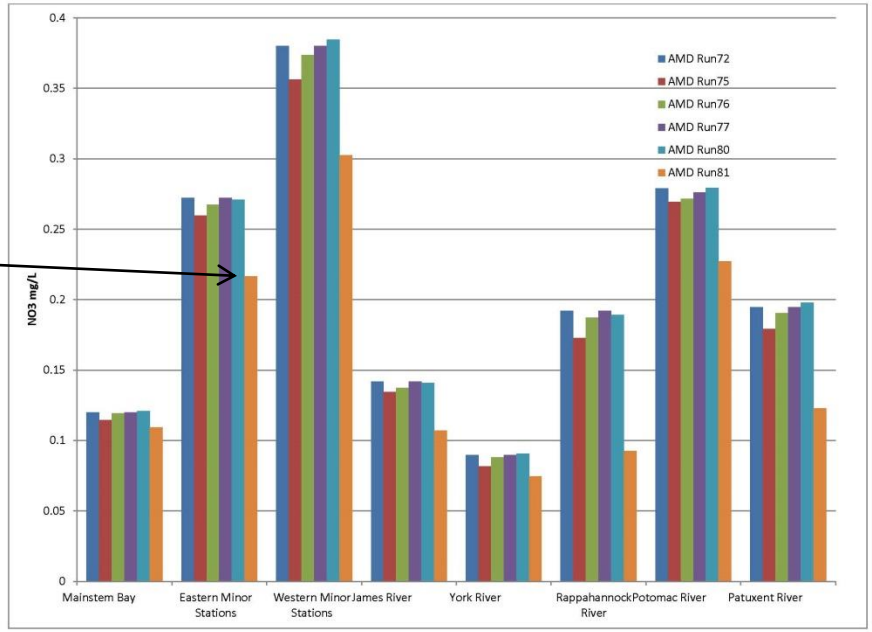
Statistical Comparisons

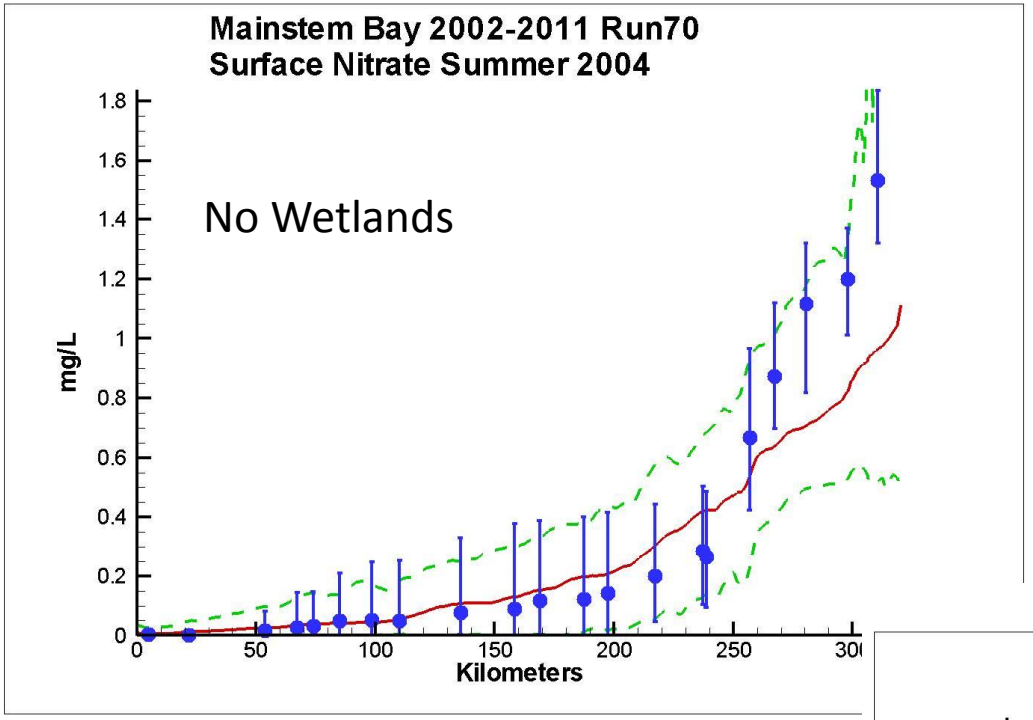
Mean Difference

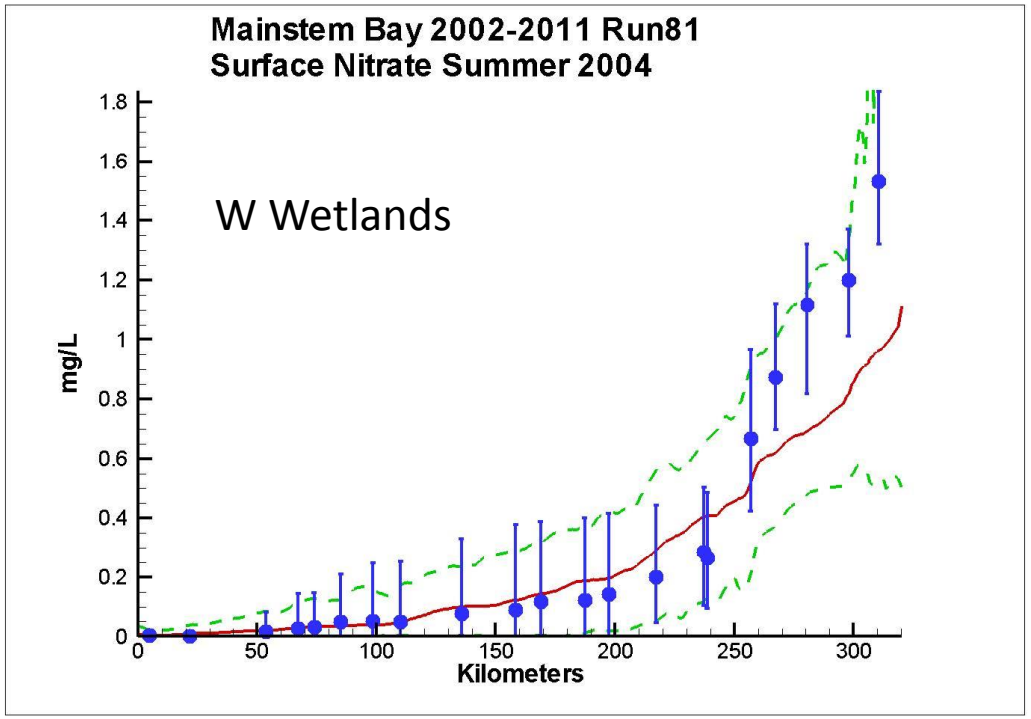


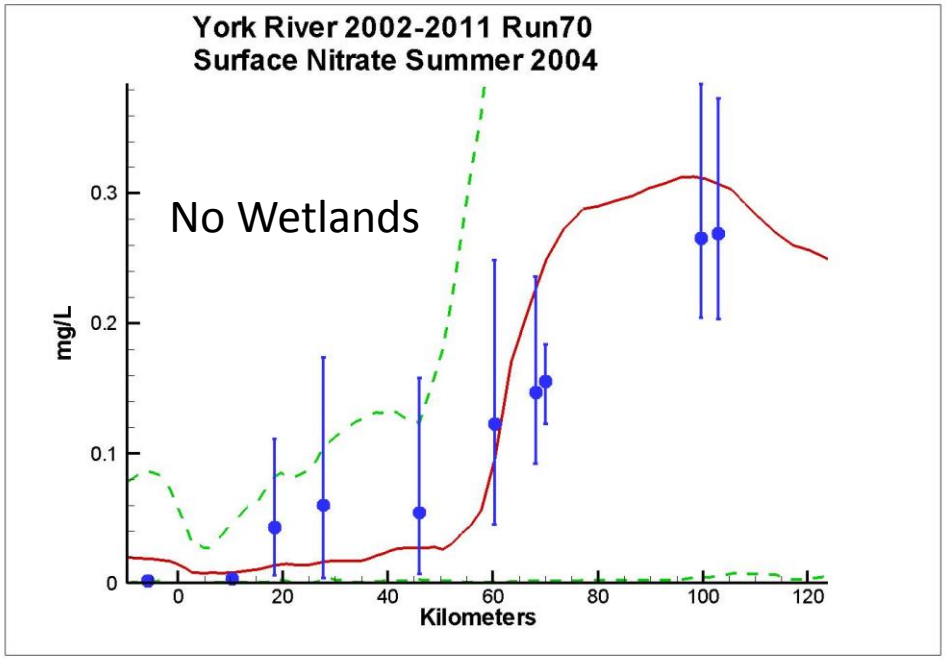
Wetlands Denitrification

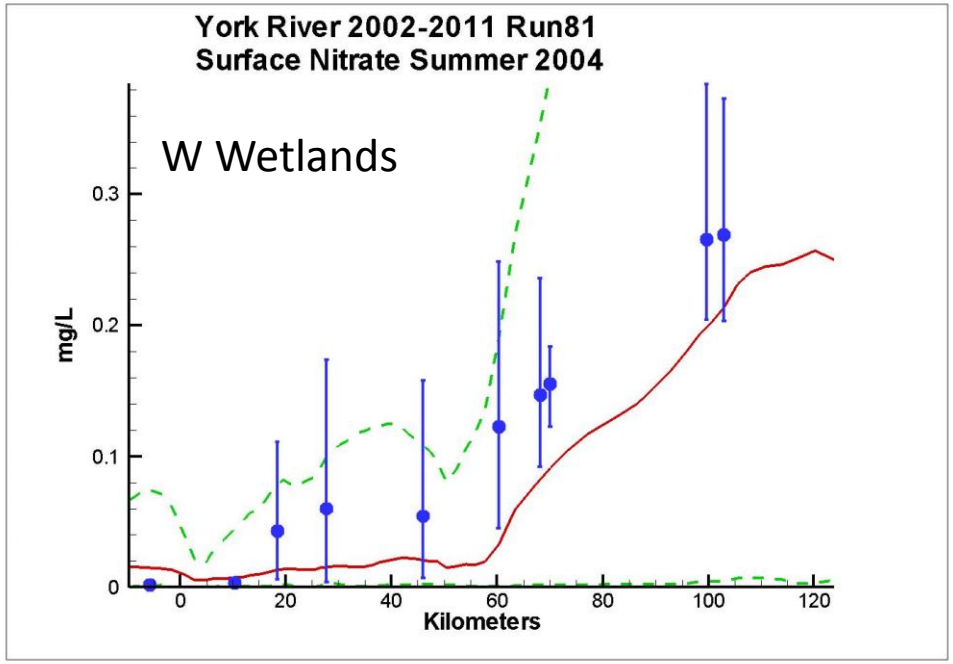
Absolute Mean Difference




Mainstem Bay 2002-2011 Run70
Surface Nitrate Summer 2004
No Wetlands
mg/L
Kilometers
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
50
100
150
200
250


Mainstem Bay 2002-2011 Run81
Surface Nitrate Summer 2004
W Wetlands
mg/L
Kilometers
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
50
100
150
200
250
300


York River 2002-2011 Run70
Surface Nitrate Summer 2004
No Wetlands
mg/L
0.3
0.2
0.1
0
0
20
40
60
80
100
120
Kilometers


York River 2002-2011 Run81
Surface Nitrate Summer 2004
W Wetlands
mg/L
0.3
0.2
0.1
0
0
20
40
60
80
100
120
Kilometers

A177 fx could remove 30% of recently deposited carbon. Suggested the remainder was lost due to storm events and historic variability in rates.

Review relevant Chesapeake Bay wetlands literature

Flemer, D., Heinle, D., Keefe, C., and Hamilton, D. (1978). "Standing crops of marsh vegetation of two tributaries of Chesapeake Bay," Estuaries, 1(3), 157-163

Estimated that annually 27 x 10^3 mt of live standing biomass on a dry weight basis is produced in 1910 ha of Patuxent River tidal fresh wetlands. This is equivalent to 1414 g DW/m2/annum. Use this figure when I budget burial. Also to justify respiration. In Parker Creek, a small tidal fresh tributary off CB4, they estimated 519 mt DW produced on 58 ha. Equivalent to 895 g DW/m2/annum.

Based on the last sentence in the abstract and on the interchangeable use of "standing crop" and "production," they considered annual production to be equivalent to the maximum standing crop.

Ward, L., Kearney, M., and Stevenson, J. (1998). "Variations in sedimentary environments and accretionary patterns in estuarie marshes undergoing rapid submergence, Chesapeake Bay," Marine Geology, 151, 111-134.

Measured accretion rates and sediment properties in two environments, Nanticoke River and Monie Bay. They further divided the Nanticoke into channel margin and interior marshes. The divided Monie Bay into submerged upland and Bay margin.

	LOI (%)	Bulk Density (g/cm3)
Channel Margin	26.1	0.42
Interior marshes	28.2	0.33
Submerged upland	55.9	0.16
Bay margin	6.3	1.17

The values above are reported means. The LOI is an indication of organic matter. It is highly variable.

Accretion rates in the channel margin ranged from 0.18 to 0.74 cm/annum and tended to decrease downstream.
One accretion rate in the interior marshes was 0.19 cm/annum

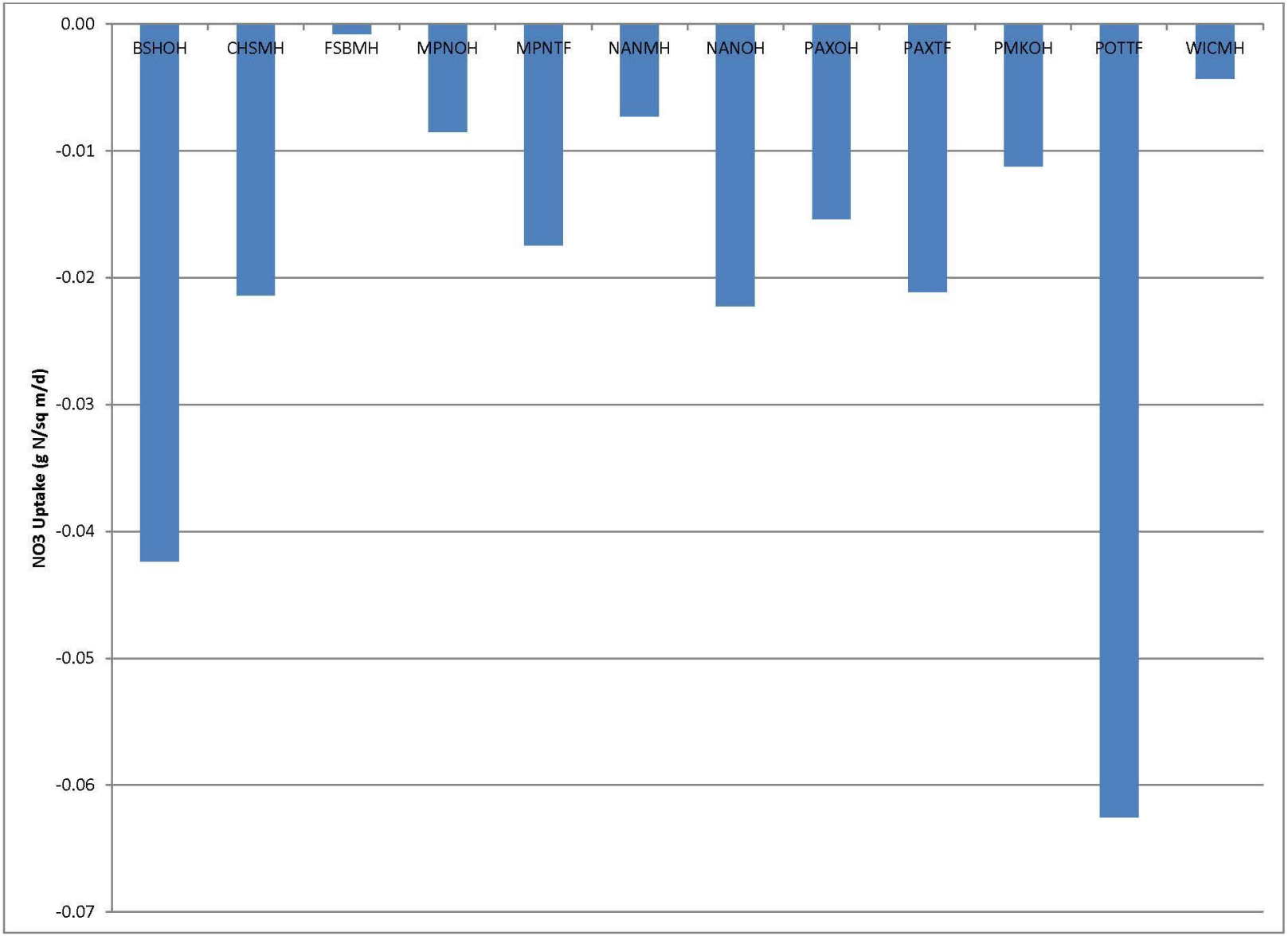
In monie Bay, accretion rates varies from 0.15 to 0.63 cm/annum. Most less than rate of sea level rise which is 0.4 cm/annum.

If I take accretion rate and multiply by Bulk Density, I should get deposition rate. The individual rates are in figures, Digitize and take means

Nanticoke				Monie Bay			
Station	ruler	factor	cm/year	Station	ruler	factor	cm/yr
N7	0.2	1.07	0.21	MB7	0.7	0.39	0.28
N6	0.45	1.07	0.48	MB2	0.9	0.39	0.35
N11	0.35	1.07	0.37	MB3	0.45	0.39	0.18
N10	0.18	1.07	0.19	MB16	0.7	0.39	0.28
N2	0.42	1.07	0.45	MB15	0.9	0.39	0.35
N5	0.68	1.07	0.73	MB14	0.58	0.39	0.23
N3 (interi	0.18	1.07	0.19	MB13	0.45	0.39	0.18
				MB9	1.1	0.39	0.43
				MB12	0.58	0.39	0.23
				MB8	1.25	0.39	0.49
				MB18	0.35	0.39	0.14
				MB4	0.85	0.39	0.33
				MB6	1.8	0.39	0.71

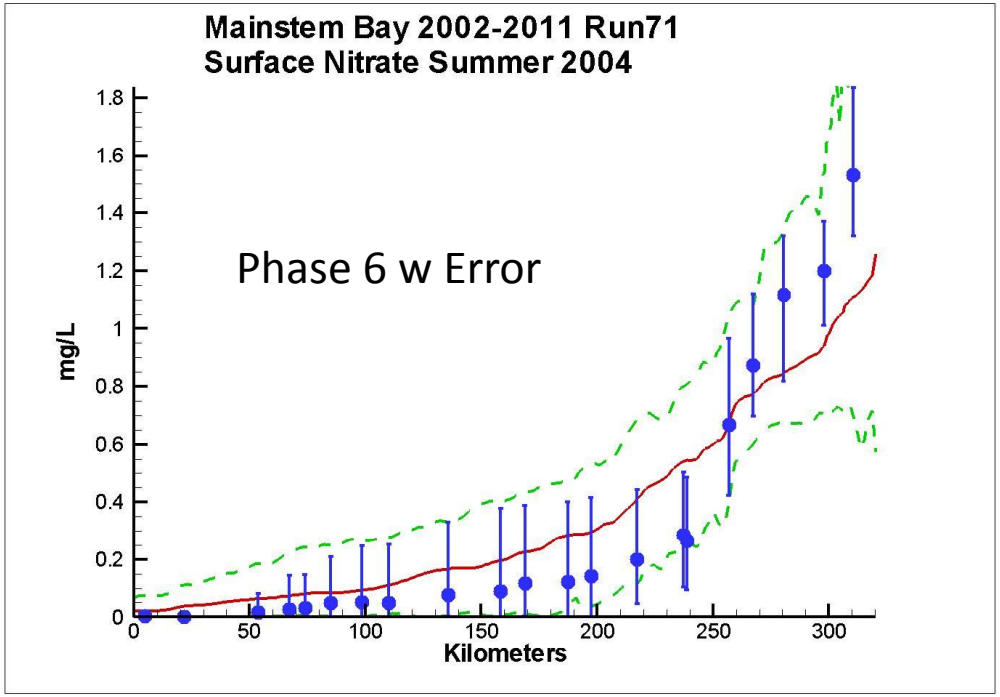
Mean Accretion Rates (cm/yr)		g/cm2/yr	organic g/m2/d	inorganic g/m2/d
Channel Margin	0.36	0.150	1.07	3.03
Interior Marshes	0.25	0.082	0.63	1.61
Submerged Upland				
Bay Margin	0.27	0.316	0.55	8.12

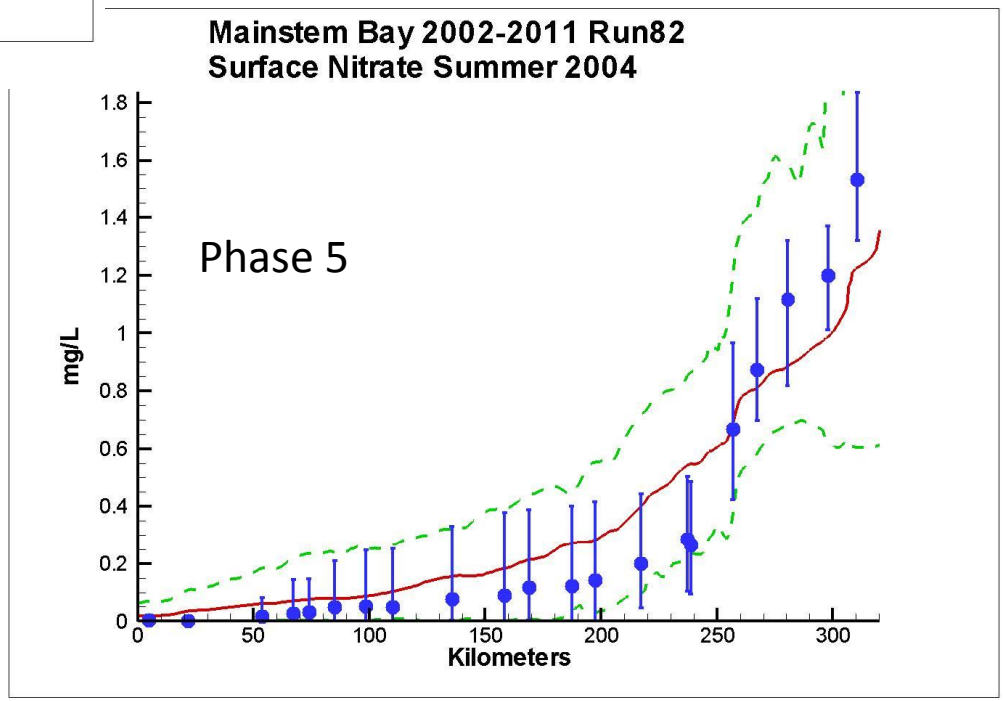
Looks like the Bay margin accumulates a lot of inorganic material while the interior marshes accumulate less. So that's why the interior marshes are eroding away.

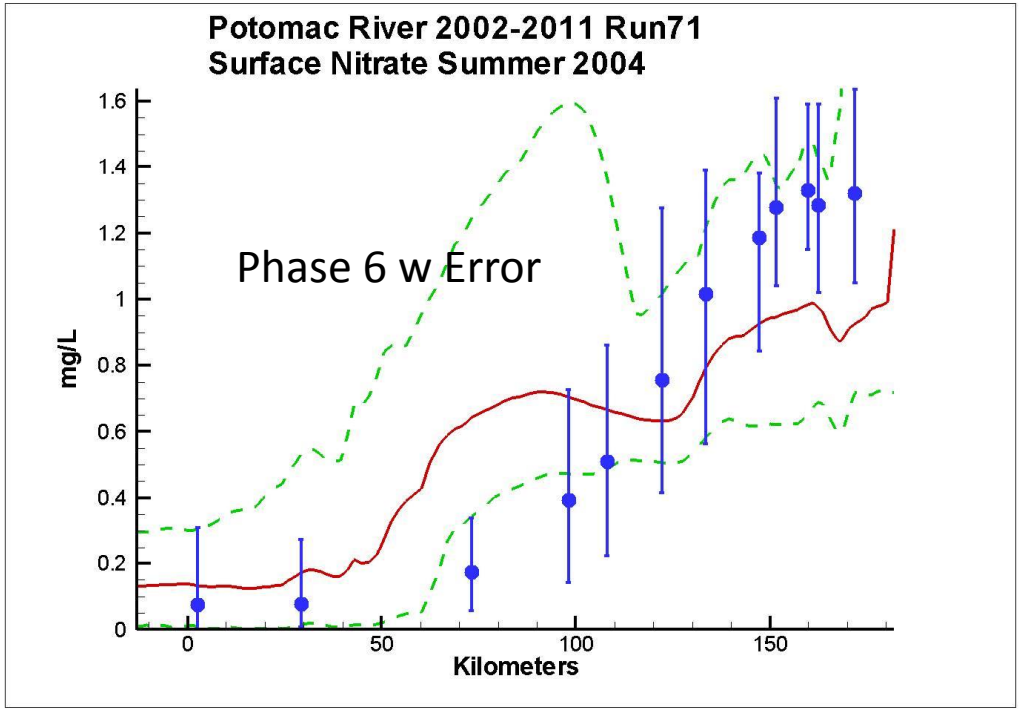

0.00
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
-0.07
NO3 Uptake (g N/sq m/d)
BSHOH
CHSMH
FSBMH
MPNOH
MPNTF
NANMH
NANOH
PAXOH
PAXTF
PMKOH
POTTF
WICMH

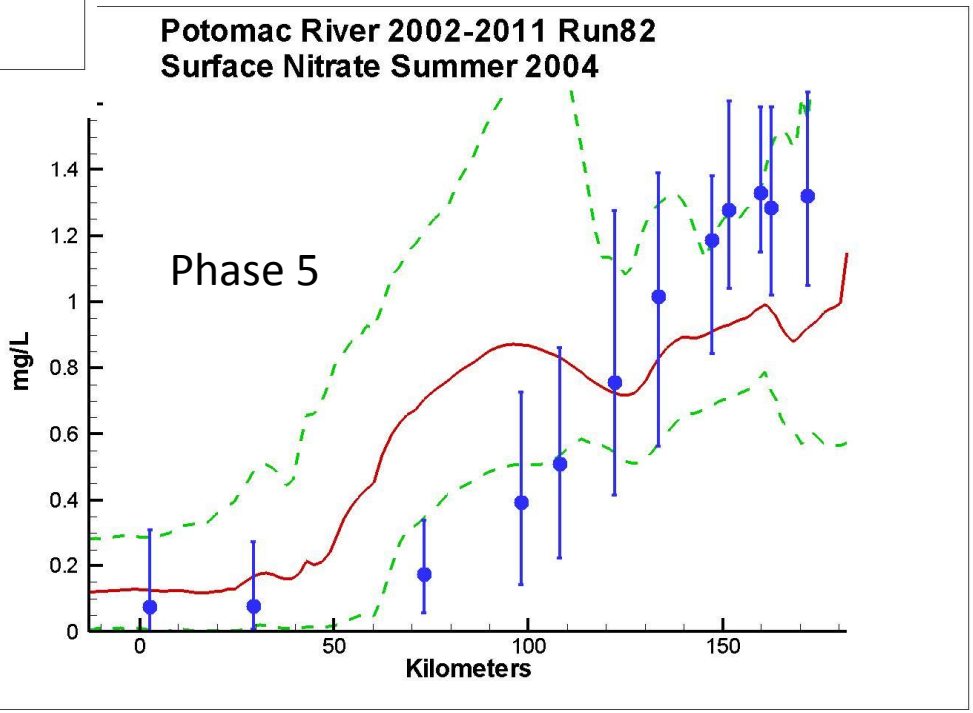
CH3D

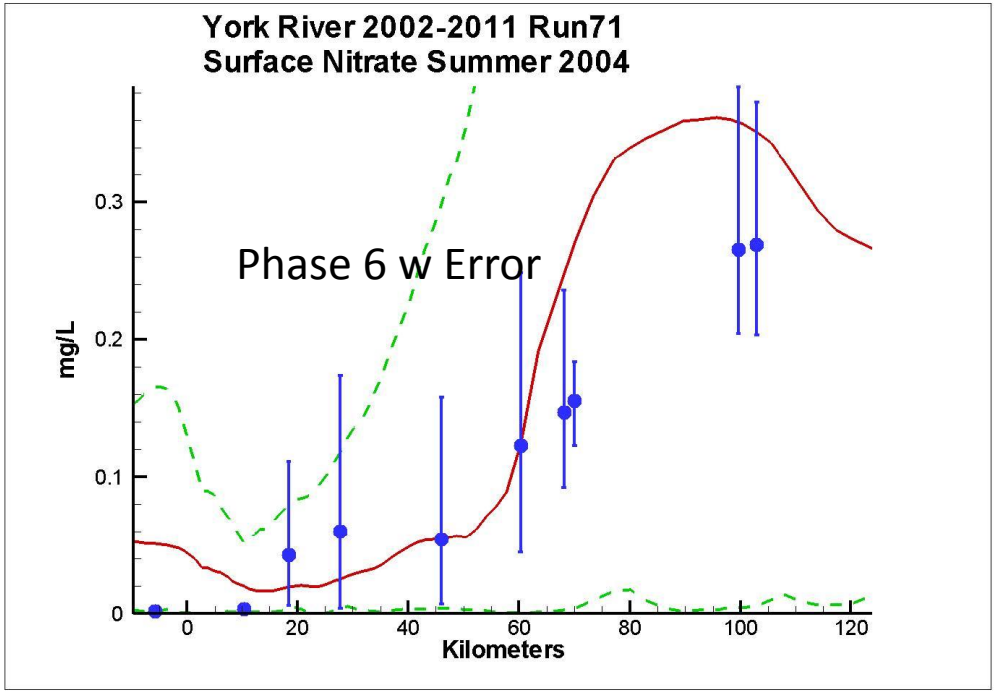
- The CBP discovered a problem with routing distributed flows from the WSM to CH3D hydrodynamic model.
- CBP is working frantically to re-run hydrodynamics 2002-2011.
- Let's examine the implications of this problem.
- We can substitute 2002-2005 hydrodynamics based on WSM Phase 5.3.2 into our 2002-2011 sequence.

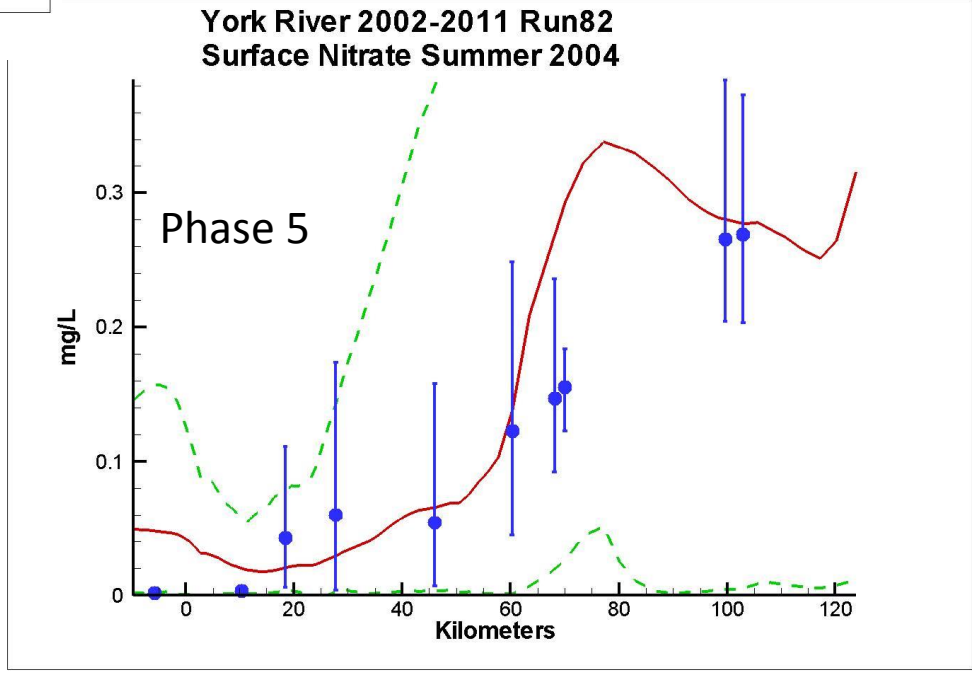

Mainstem Bay 2002-2011 Run71
Surface Nitrate Summer 2004
Phase 6 w Error
mg/L
Kilometers
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
0
50
100
150
200
250
300

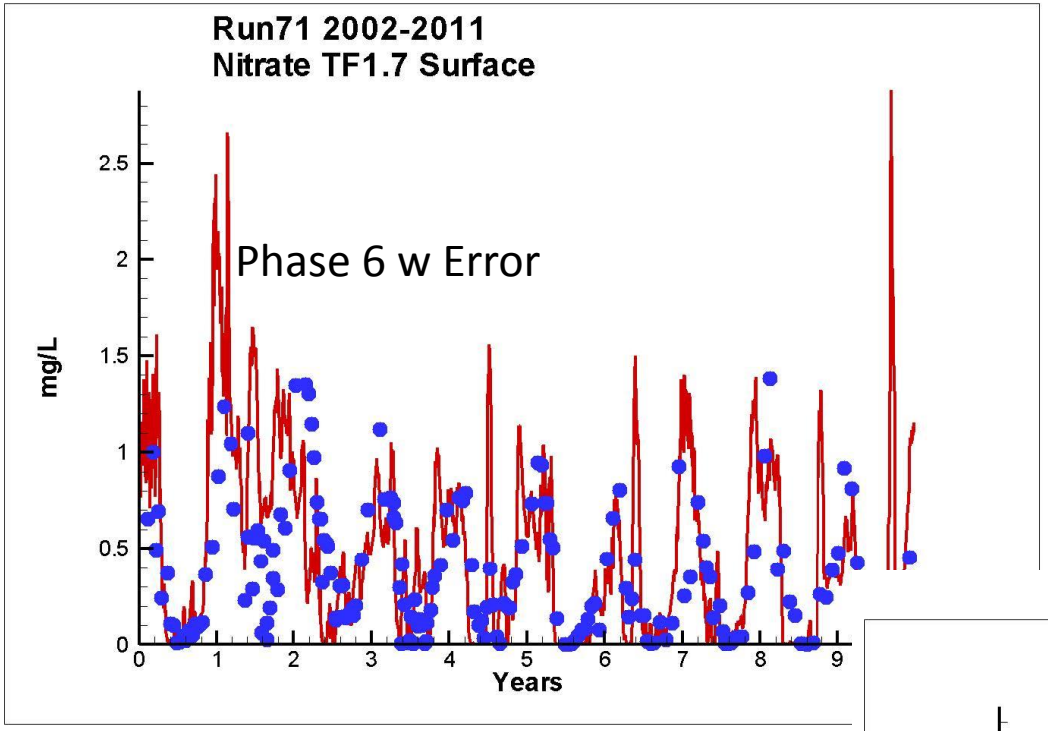

Mainstem Bay 2002-2011 Run82
Surface Nitrate Summer 2004
Phase 5
mg/L
Kilometers
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
0
50
100
150
200
250
300

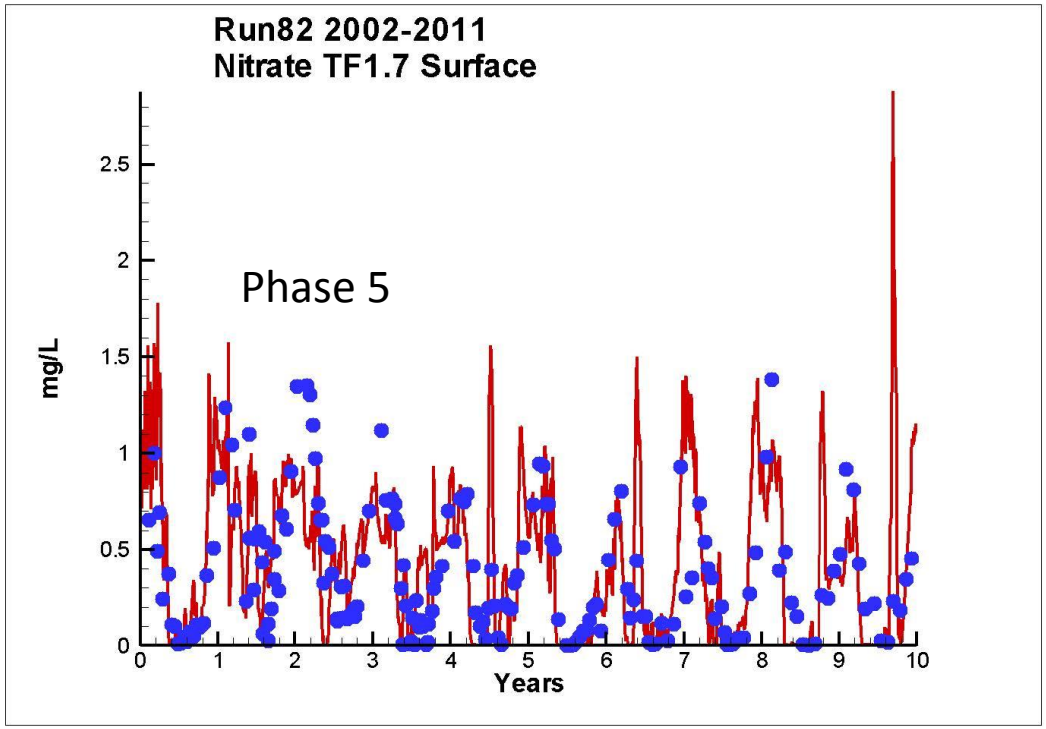

Potomac River 2002-2011 Run71
Surface Nitrate Summer 2004
Phase 6 w Error
mg/L
Kilometers
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
0
50
100
150

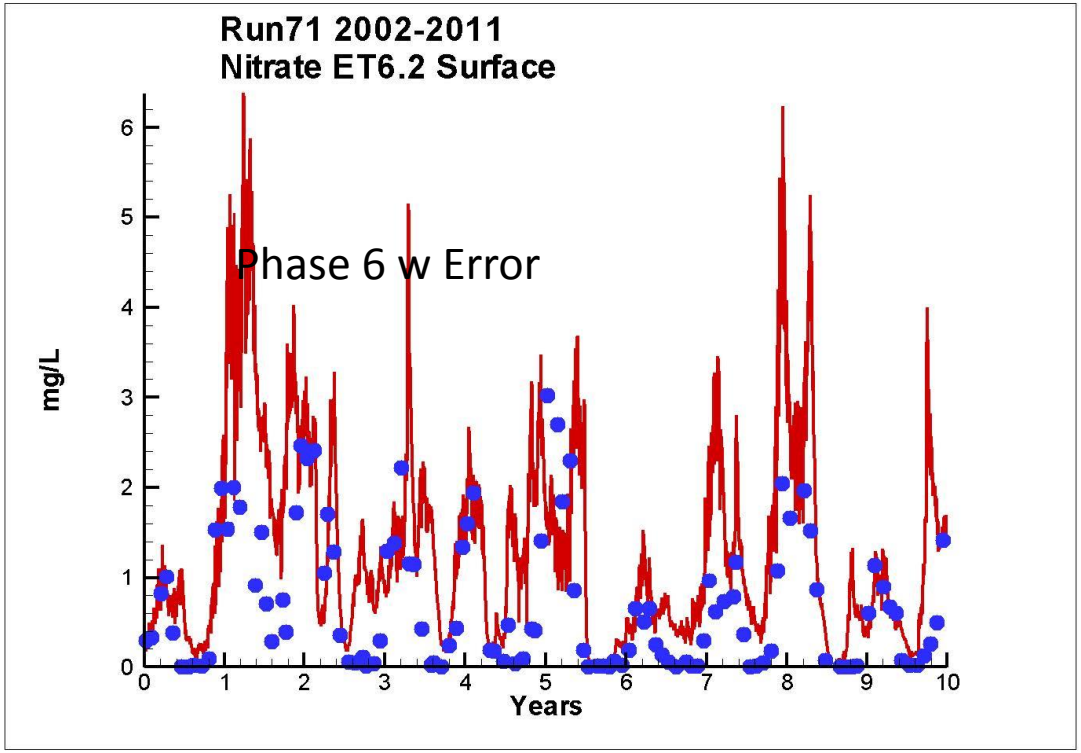

Potomac River 2002-2011 Run82
Surface Nitrate Summer 2004
Phase 5
mg/L
Kilometers
0
0.2
0.4
0.6
0.8
1
1.2
1.4
0
50
100
150

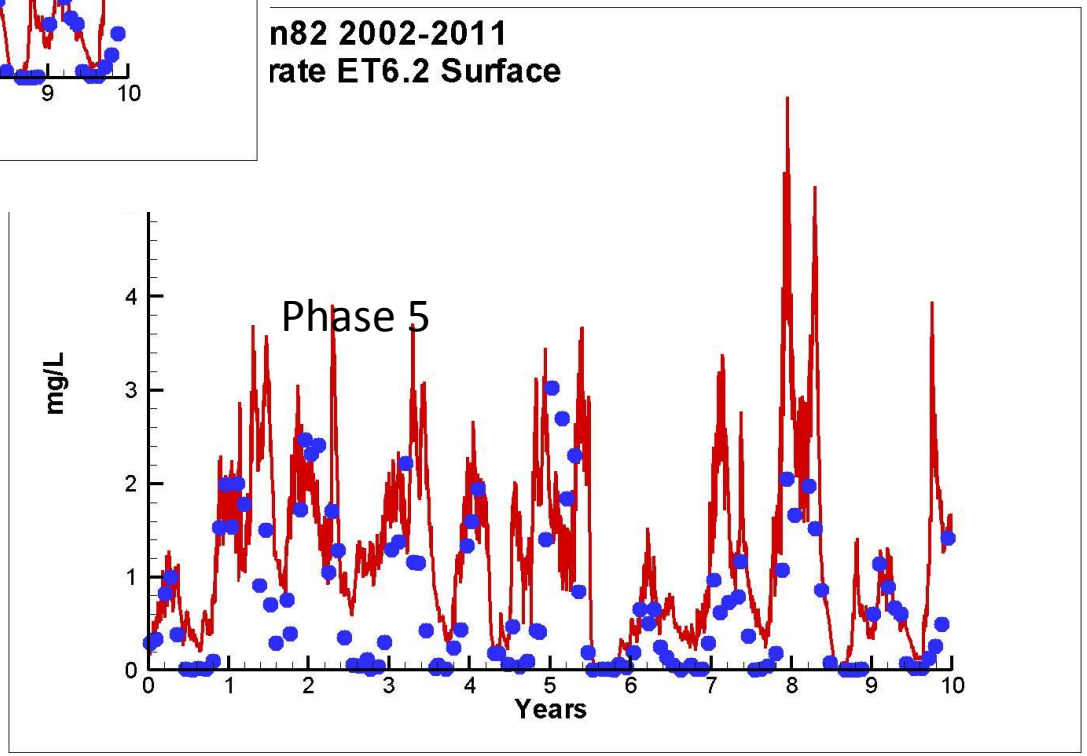

York River 2002-2011 Run71
Surface Nitrate Summer 2004
Phase 6 w Error
mg/L
0
0.1
0.2
0.3
0
20
40
60
80
100
120
Kilometers


York River 2002-2011 Run82
Surface Nitrate Summer 2004
Phase 5
mg/L
0
0.1
0.2
0.3
0
20
40
60
80
100
120
Kilometers


Run71 2002-2011
Nitrate TF1.7 Surface
Phase 6 w Error
mg/L
Years
0
0.5
1
1.5
2
2.5
0 1 2 3 4 5 6 7 8 9


Run82 2002-2011
Nitrate TF1.7 Surface
Phase 5
mg/L
Years
0
0.5
1
1.5
2
2.5
0 1 2 3 4 5 6 7 8 9 10


Run71 2002-2011
Nitrate ET6.2 Surface
Phase 6 w Error
mg/L
Years
0
1
2
3
4
5
6
7
8
9
10


n82 2002-2011
rate ET6.2 Surface
Phase 5
mg/L
Years
0
1
2
3
4
5
6
7
8
9
10

Good News/Bad News

- As we would expect, the differences are pronounced in regions where distributed flows are a large fraction of total freshwater runoff. E.g. upper York and Patuxent, some Eastern Shore tributaries.
- Good news. Doesn't look like this will necessitate major recalibration efforts.
- Bad news. Resolving this error probably won't resolve the problems we do have.
- Are we going to revise more years of hydrodynamics for consistency with Phase 6 WSM?

Other Activities

- General adjustments to calibration as needed.
- Reviewing sediment diagenesis model:
  - Some of the parameters, for example burial, have been transferred from the 4,000-cell model. Need examination.
  - Incorporate SONE measures, mostly tributaries, collected 2002 – 2005.