Recommendations for Phase 6-PQUAL Nitrogen Sensitivity

Modeling Quarterly Review Meeting
January 28, 2015

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Objectives

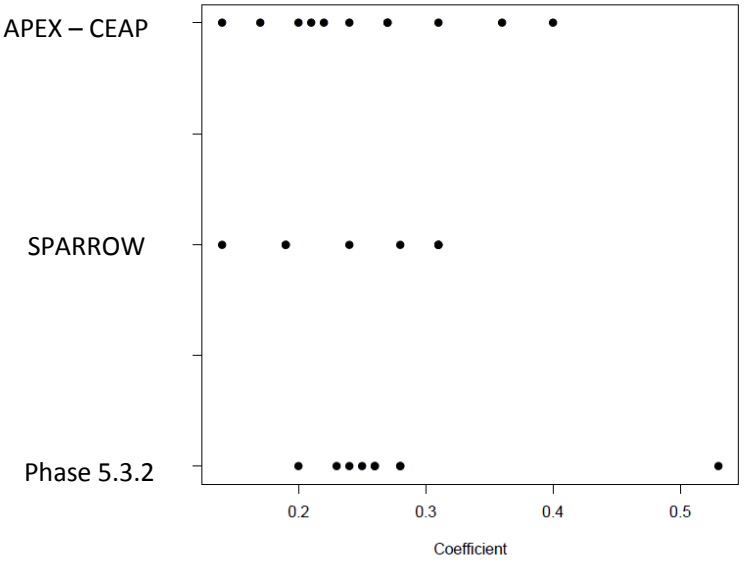
- To estimate sensitivity to nutrient inputs in the Chesapeake Bay Watershed using multiple watershed models
- To review and implement sensitivities in the phase 6 version of the Chesapeake Bay Watershed model
- To decide on Phase 6-PQUAL nitrogen sensitivities

** The input-output relationship or the effect of changes in nutrient inputs on nutrient export is referred to in this analysis as sensitivity.*

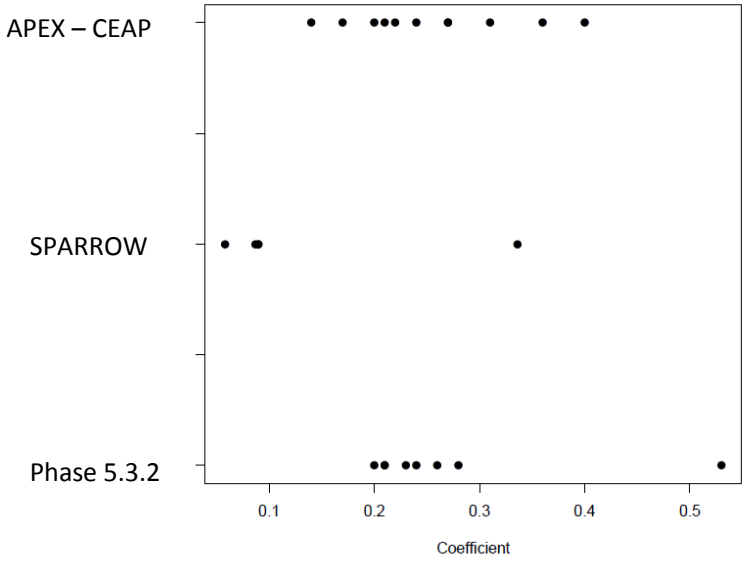
Sensitivities to total nitrogen inputs

- Following STAC recommendations, nutrient sensitivities from multiple models i.e. APEX, SPARROW, and P532-AGCHEM models were identified.
- The multiple models sensitivities represent the relationship between nutrient predicted yields and input loads for cropland.
- Other models sensitivities are not contradictory to p532

Sensitivity to fertilizer TN inputs



Sensitivity to manure TN inputs



1. APEX – CEAP: Ratio between output and input (No-practice, 2006, and 2011 scenarios including all input sources in cropland areas)
2. SPARROW: source specific coefficient (Various studies in the Chesapeake bay and Northeastern and Mid-Atlantic regions) *
3. Phase 5.3.2: Ratio between input and output, slope of multivariate regression, and slope between output and input (14 scenarios , hwm, hom, lwm, alf, and hyw)

* Preston and Brakebill (1999), Ator et al. (2011), Moore et al. (2011), and Preston et al. (2011).

Sensitivity implementation on phase 6

- P532-AGCHEM sensitivities answer the correct question: what is the slope of the line at a normal loading rate
  - CEAP and Sparrow only have average Output/Input slope

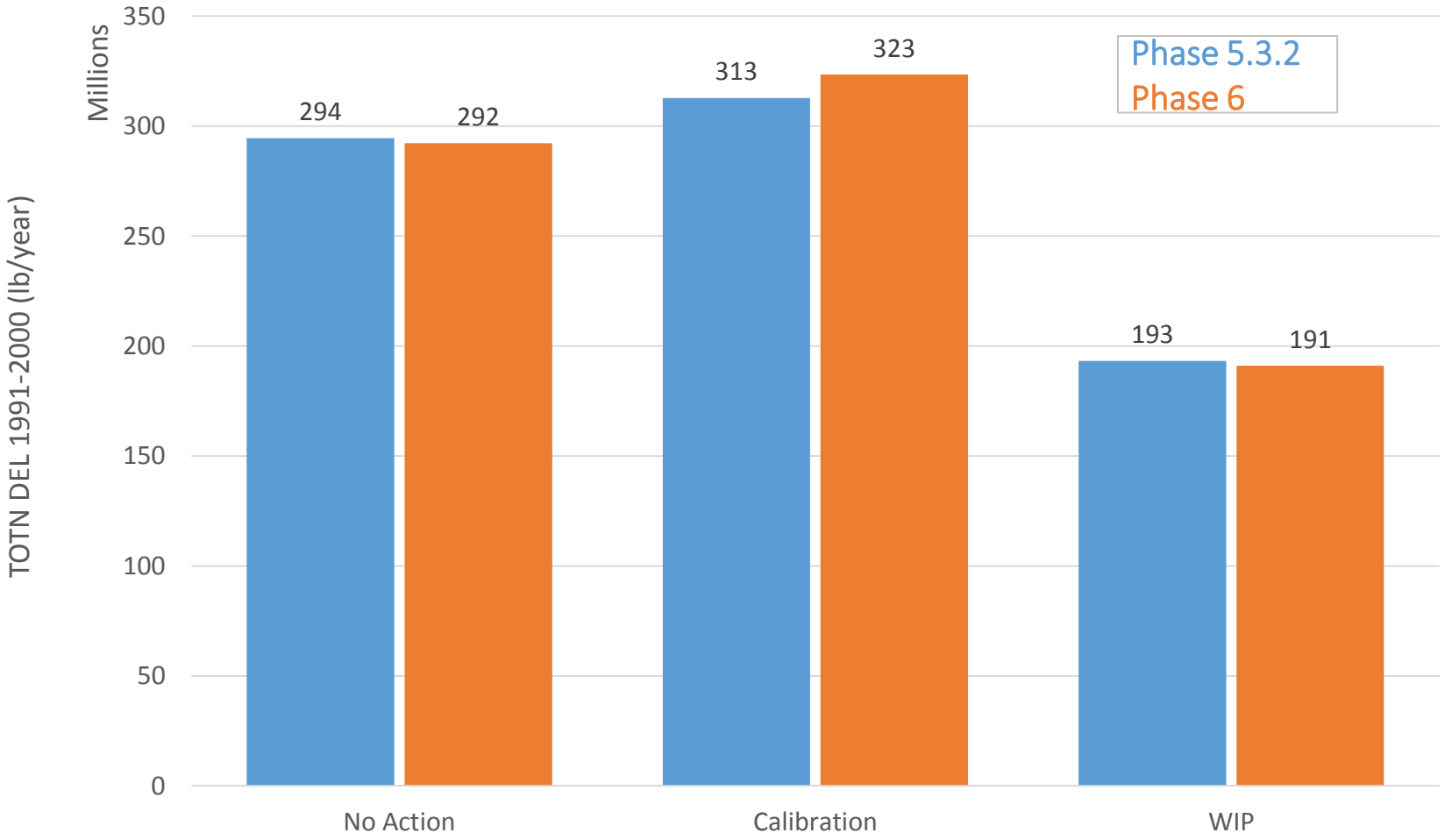
- P532-AGCHEM sensitivities are available on fine scale so that we can look at spatial differences
  - Sparrow single coefficient for CB watershed
  - CEAP is not available at a fine scale

- P532-AGCHEM sensitivities are available for different species of nutrients
  - Sparrow TN and TP only
  - CEAP species are not available

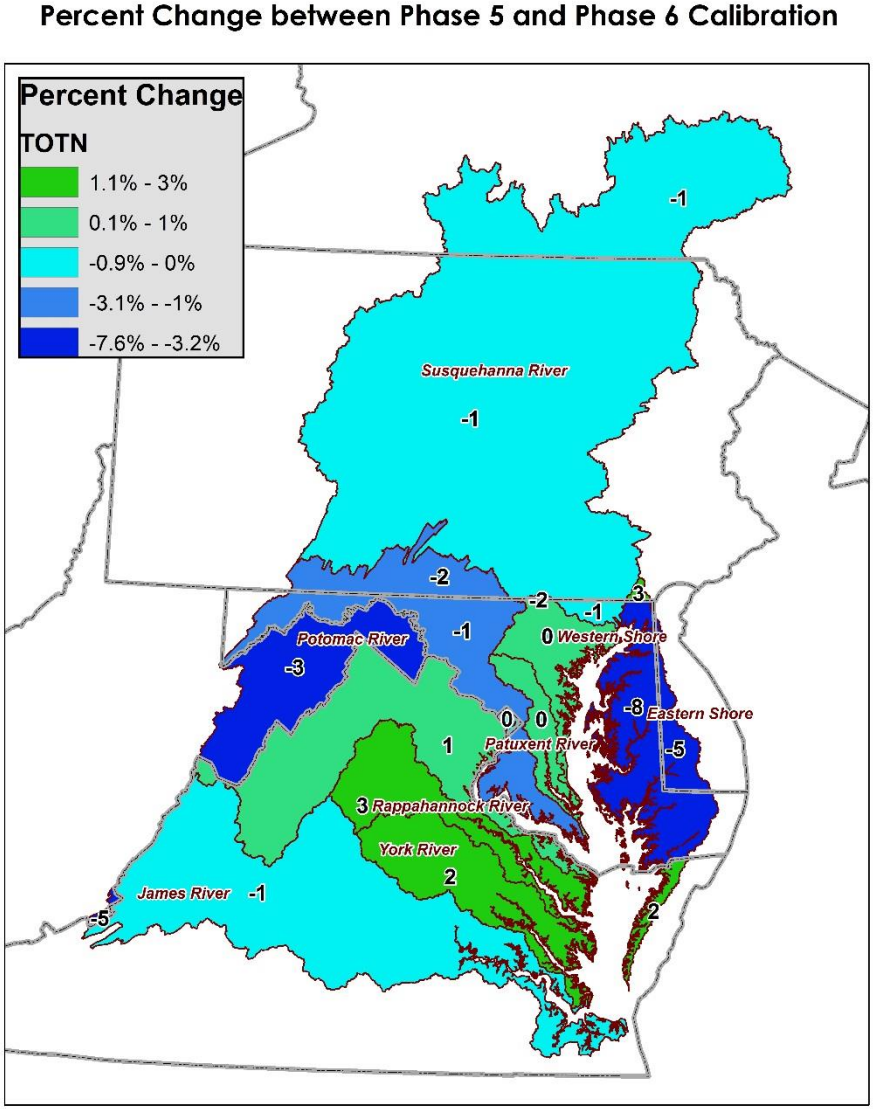
Sensitivity implementation on phase 6

- Sparrow and CEAP models support the use of P532-AGCHEM sensitivities
- Phase 532-AGCHEM DIN and organic nitrogen sensitivities were implemented in phase 6.
- Spatial differences in sensitivity were found for forest only

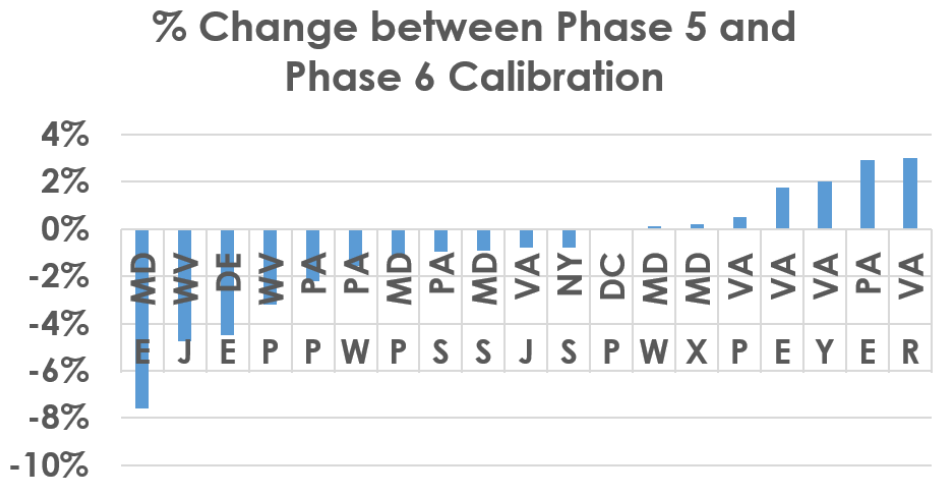
Sensitivity implementation on phase 6



Phase 6 Prototype
EOF Total Nitrogen Calibration



$$\%Change = \frac{Calib\ EOF\ _{Phase\ 6}}{Calib\ EOF\ _{Phase\ 5}} - 1$$



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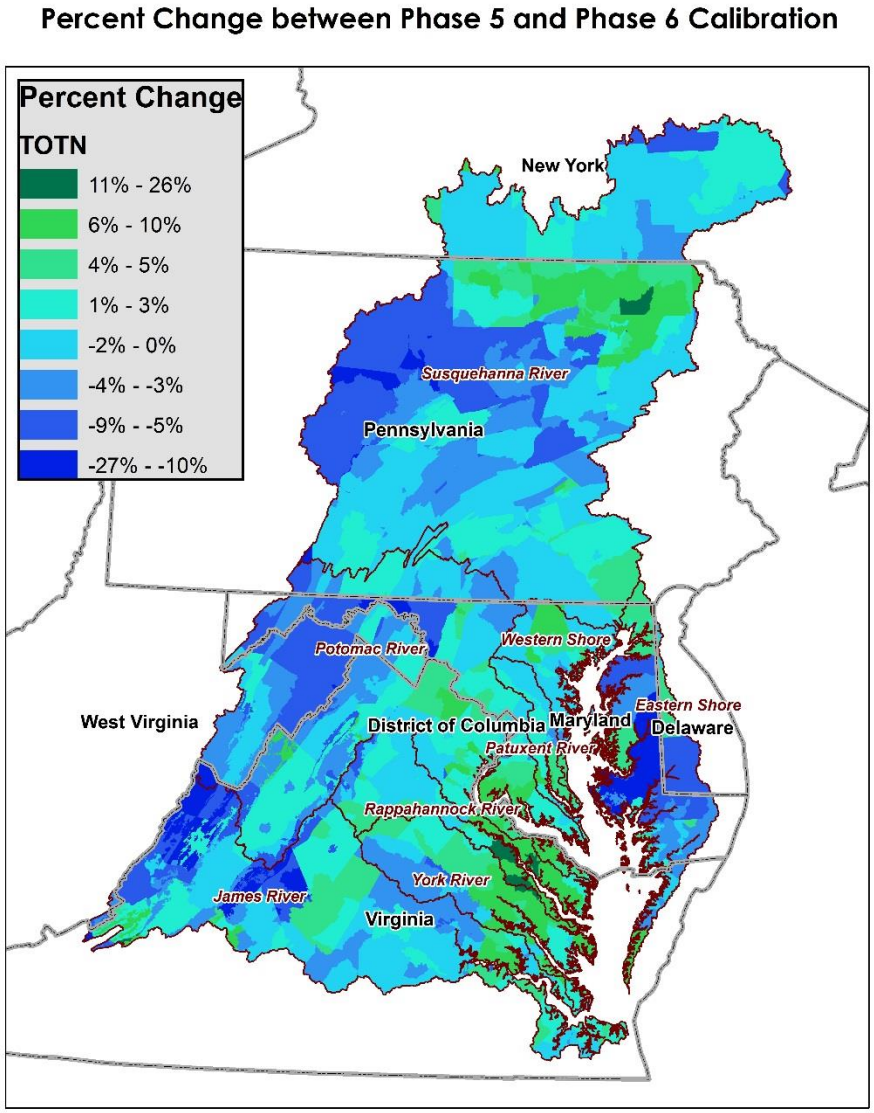

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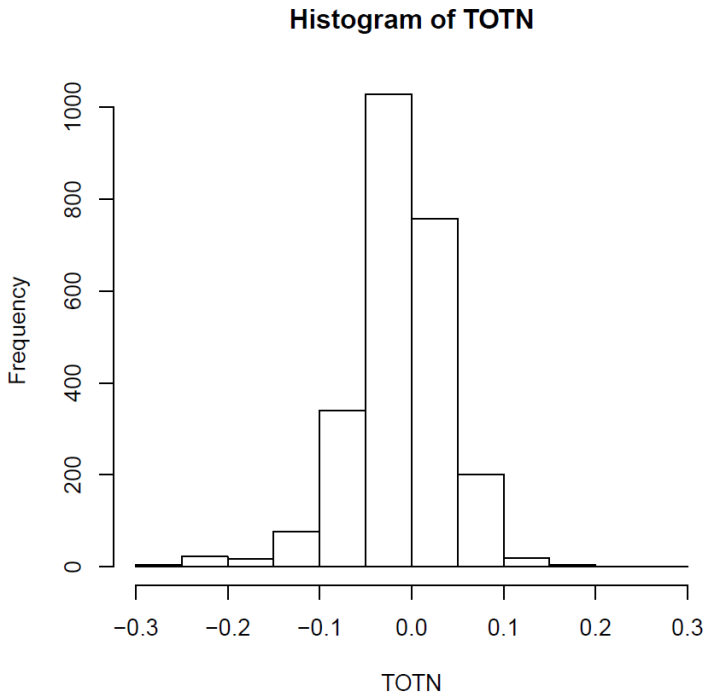
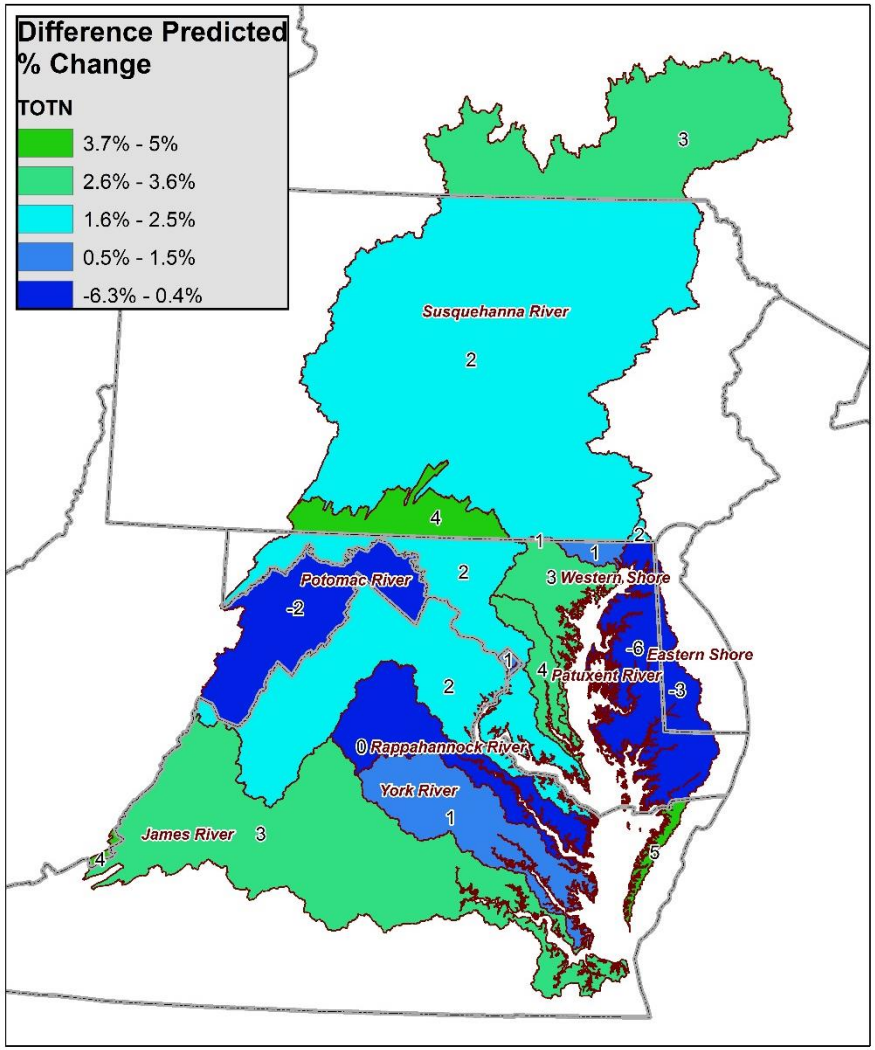
~95% of land-river segments showed a percent change between ±10%



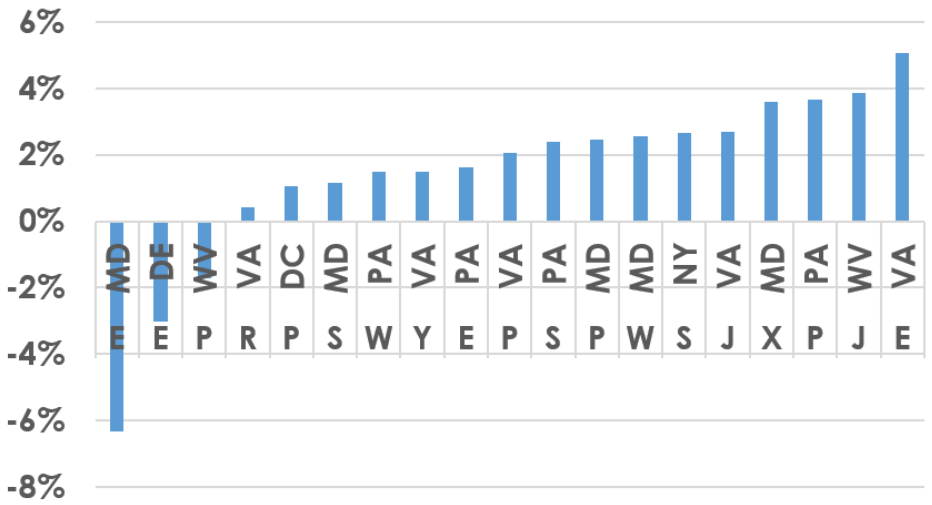
Phase 6 Prototype
EOF Scenario Simulation

Difference in Predicted % Change



$$\%\ Change_{\ Phase\ 6} - \%\ Change_{\ Phase\ 5}$$

$$\left(\frac{(Scenario - Calib)_{p6}}{Calib_{p6}} - \frac{(Scenario - Calib)_{p5}}{Calib_{p5}}\right)\%$$



Phase 6 Prototype
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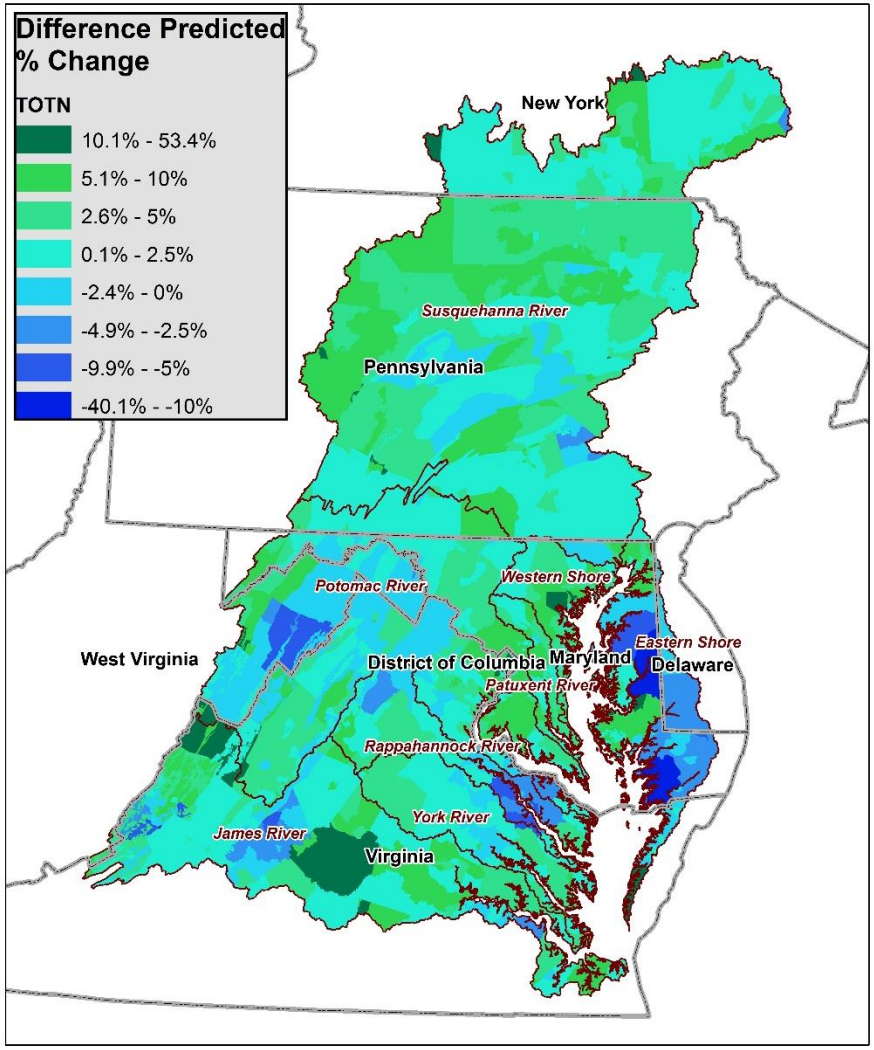

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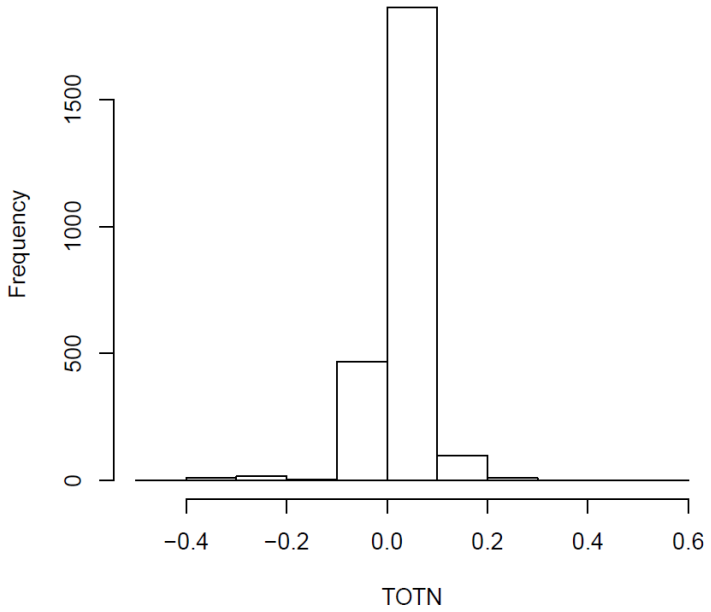

Decide on Phase 6 nitrogen sensitivities

- Phase 532-AGCHEM sensitivities are more extensive and robust than other models due to the lack of data available for management scenarios.

- The recommendation is to adopt the Phase 5.3.2 AGCHEM nitrogen sensitivities.

- Please review both the Phase 5.3.2 AGCHEM and multiple model sensitivity analyses to make a decision on Nitrogen sensitivities.

https://archive.chesapeakebay.net/Modeling/phase5/Phase532/Sensitivity /