Phase 6-PQUAL Nitrogen Sensitivity

Modeling Quarterly Review Meeting
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Guido Yactayo, Richard Tian
UMCES

Objectives

- To review the previous nitrogen sensitivity analysis (2014)

- To present the new approach

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

Phase 6

Nutrients

Phase 6 Load =

Average Load + **Sensitivity** * **Δ Inputs**

*

BMPs

*

Watershed Delivery Variance Centered on 1

*

Stream Delivery

*

River Delivery

Estimate Spatial Average EOS Based on land use and inputs

Estimate watershed delivery variance based on landscape parameters

Estimate small stream effects

Directly Simulated in HSPF

Previous Nitrogen Sensitivity Analysis Using P532-AGCHEM

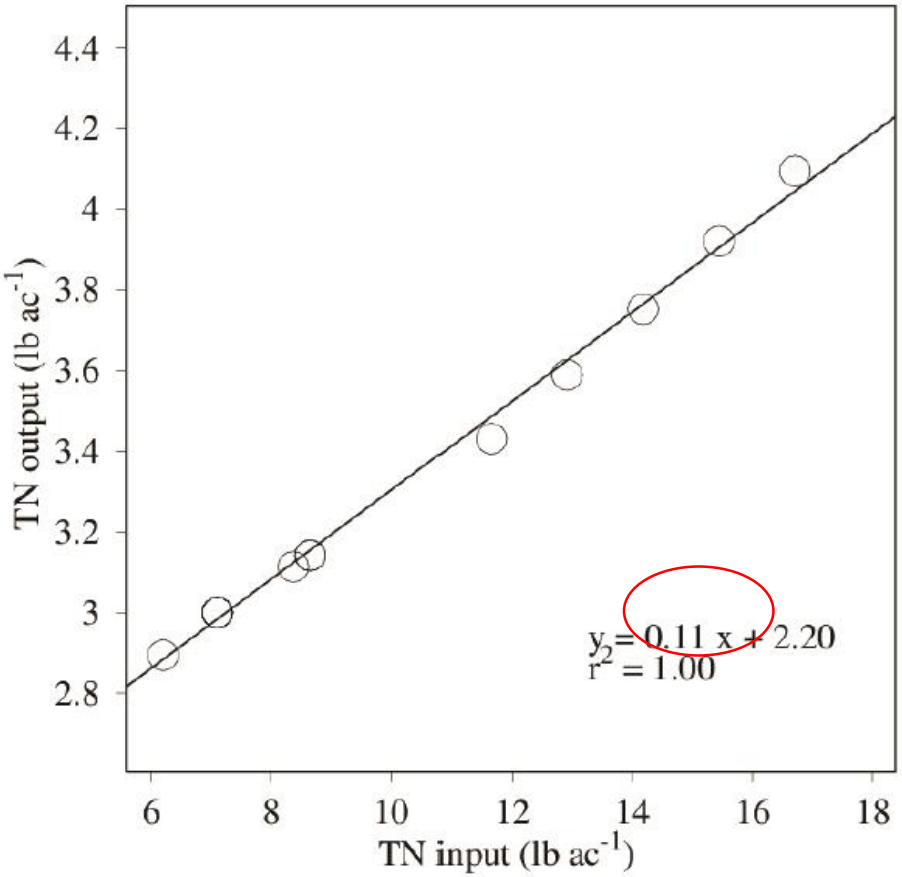
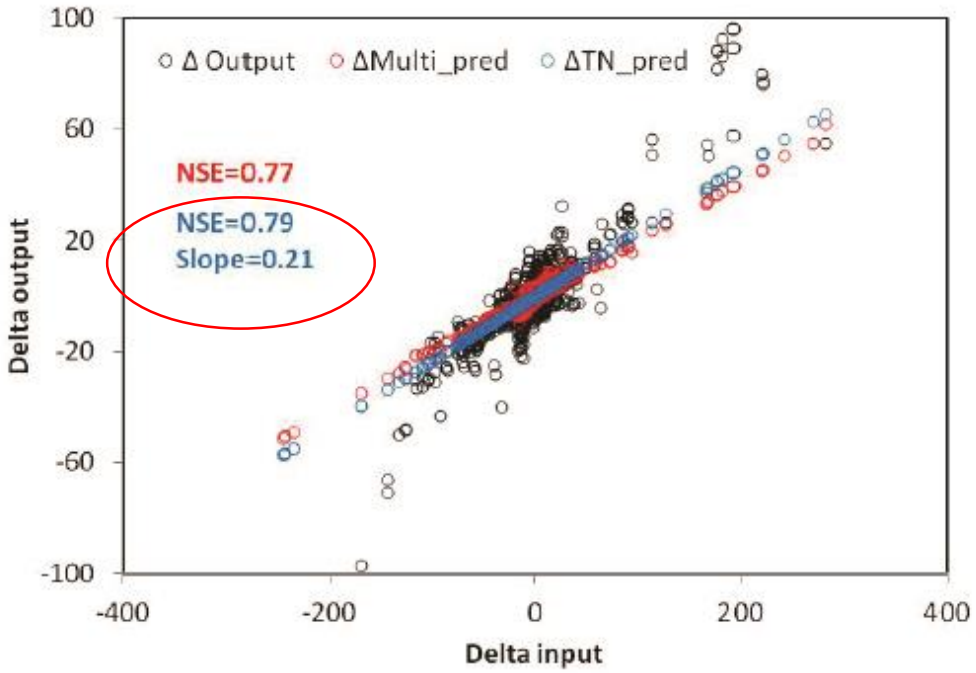


Figure 3. 1. Example of regression function between total nitrogen atmospheric deposition (TN input) and output on forest land use of the land segment A24023, Washington County, MD. Atmospheric deposition is the only type of input on forest.

(Tian, 2013)

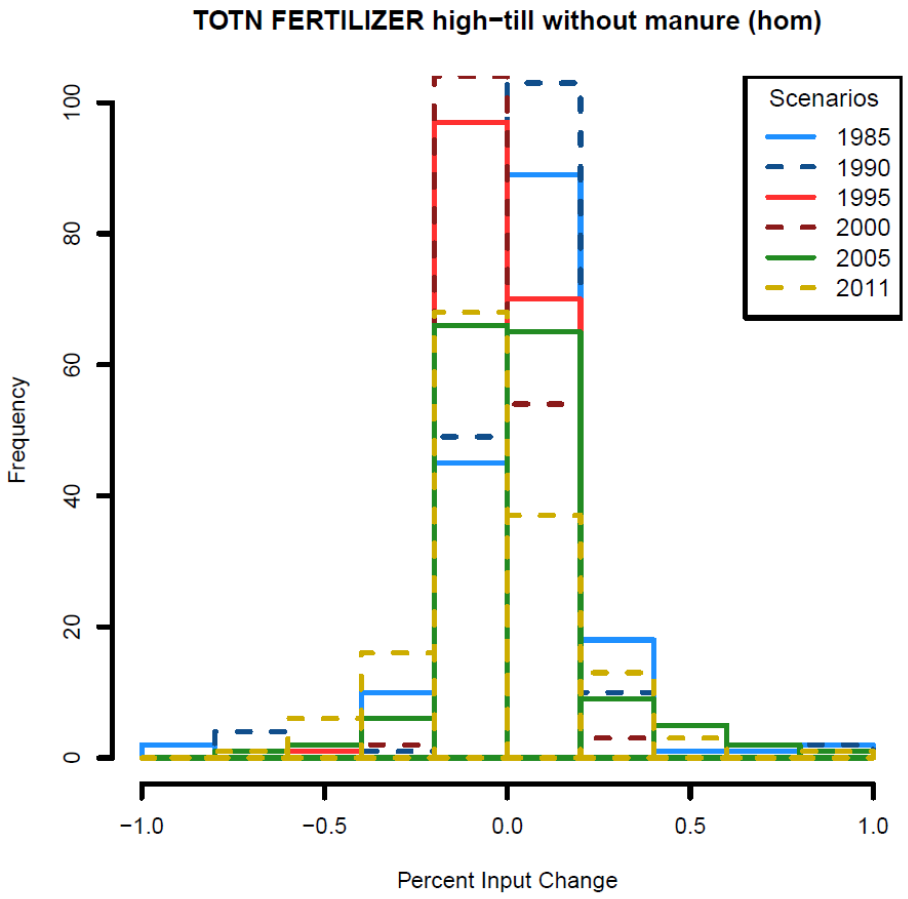
Previous Nitrogen Sensitivity Analysis Using P532-AGCHEM

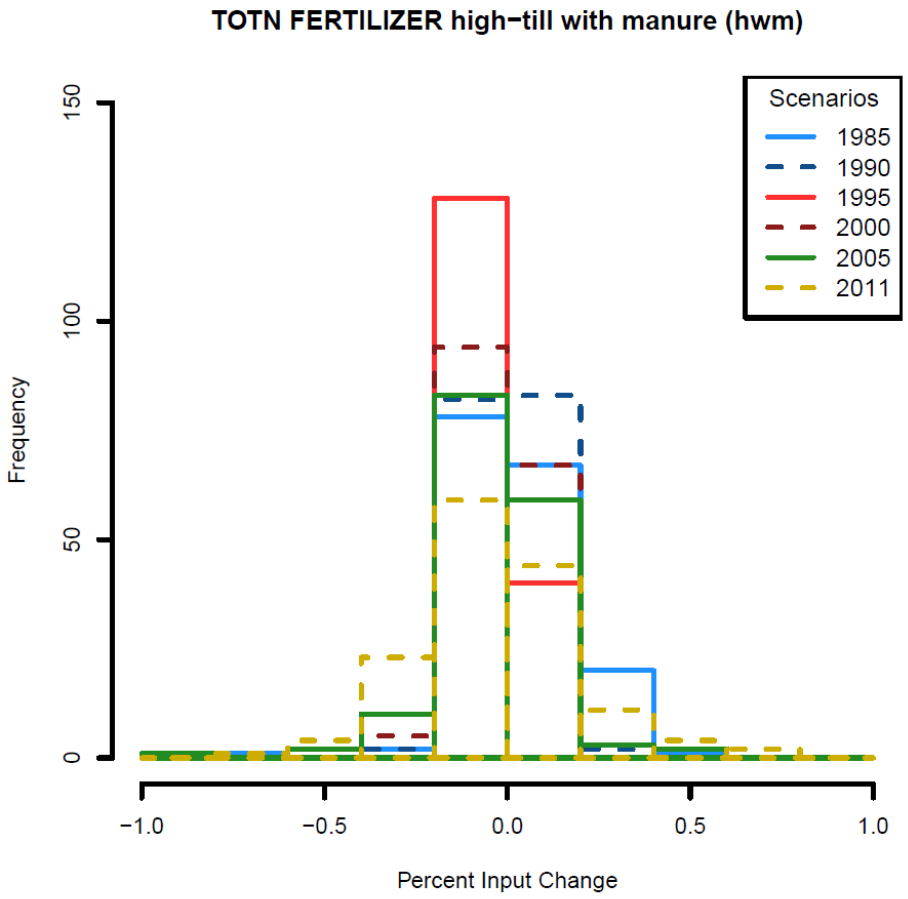


(Tian, 2013)

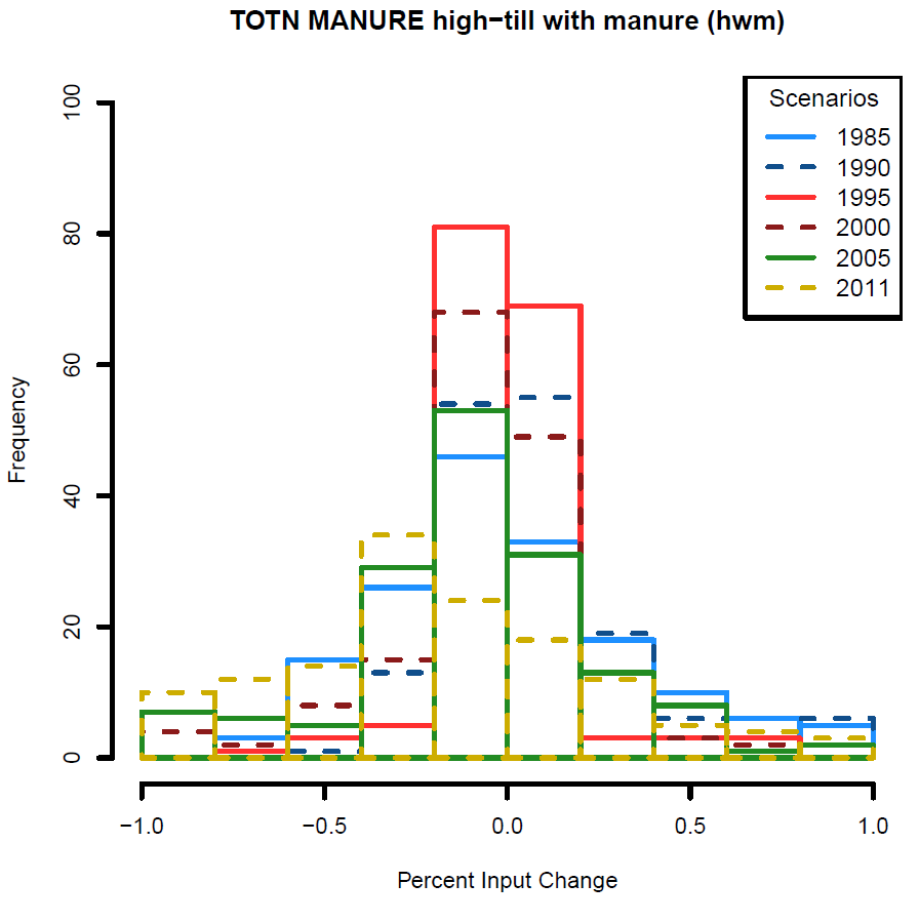
Figure 4. 3. Robustness of TN regression prediction measured by the Nash-Sutcliffe Efficiency (NSE) coefficient between model output and regression prediction on high-tillage cropland with manure (hwm). Delta input is the demeaned total nitrogen input and delta outputs are the demeaned outputs from AGCHEM (black dots) and regression prediction using both total nitrogen input (blue dots) and multi-variate regression analysis (red dots).

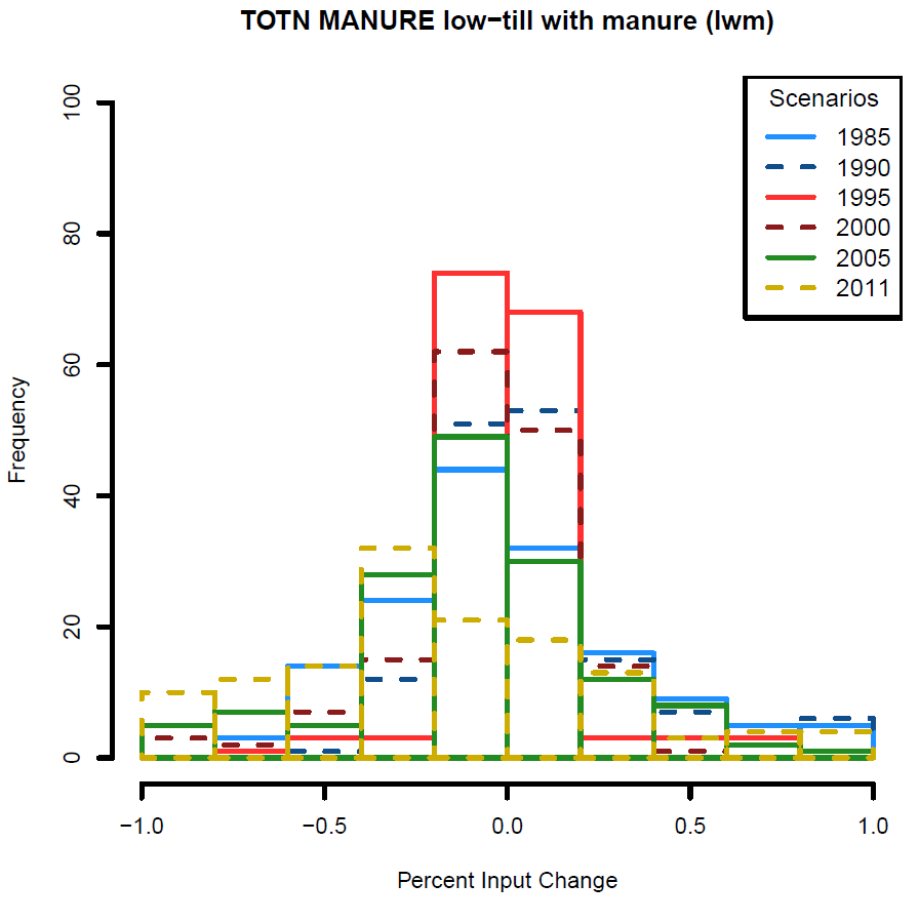
P532-AGCHEM Scenarios Input Change





P532-AGCHEM Scenarios Input Change

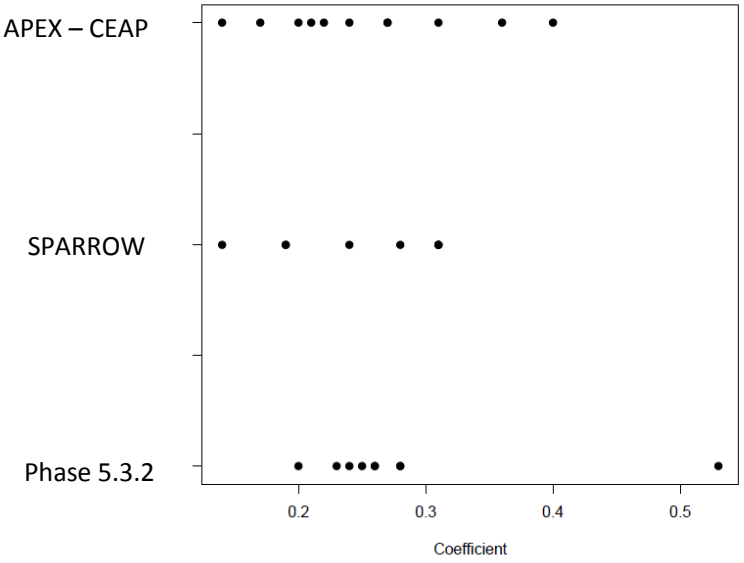




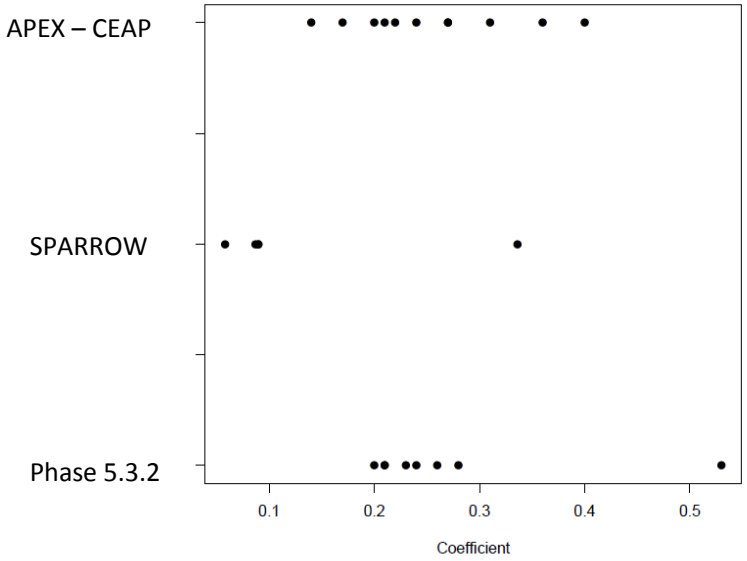
Sensitivity to Nitrogen Inputs Analysis (2014)

- Following STAC recommendation, we evaluated the sensitivity to nitrogen inputs in the Chesapeake Bay Watershed using multiple watershed models (i.e. APEX, SPARROW, and P532-AGCHEM).
- Other models sensitivities are not contradictory to P532-AGCHEM

Sensitivity to fertilizer TN inputs



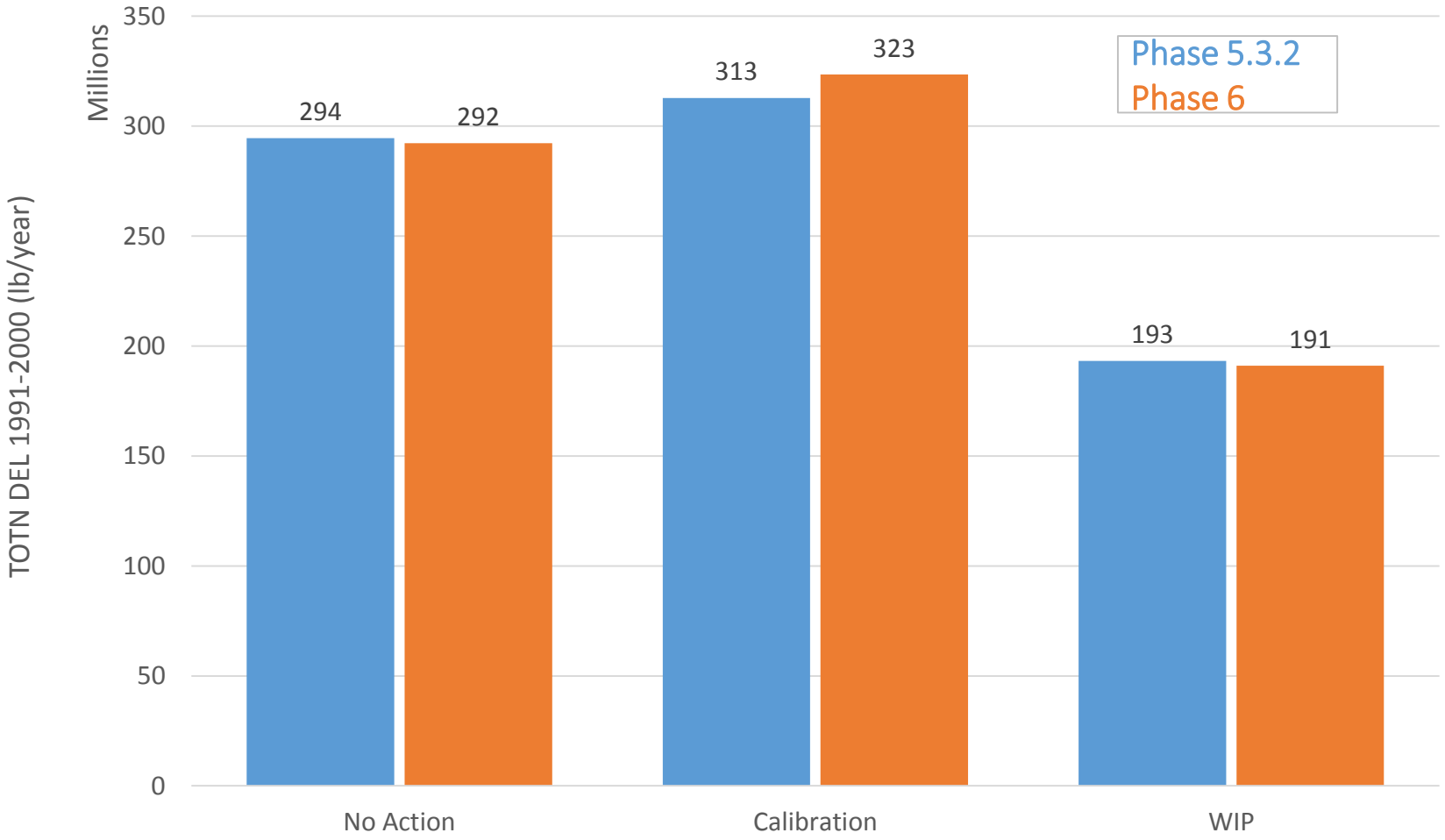
Sensitivity to manure TN inputs



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).

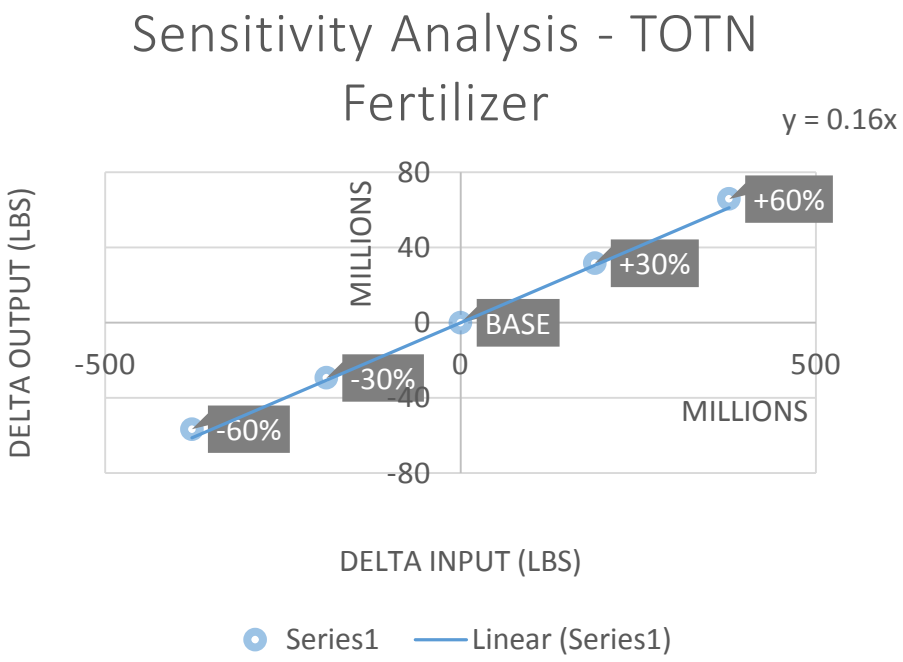
P532-AGCHEM Sensitivities (2014) on Phase 6

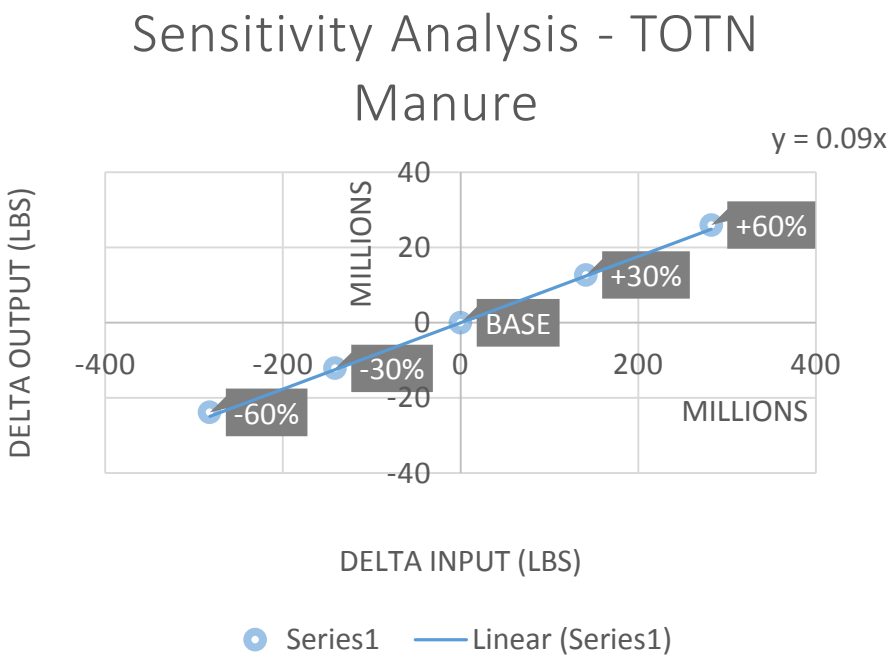


New Nitrogen Sensitivity Analysis Approach

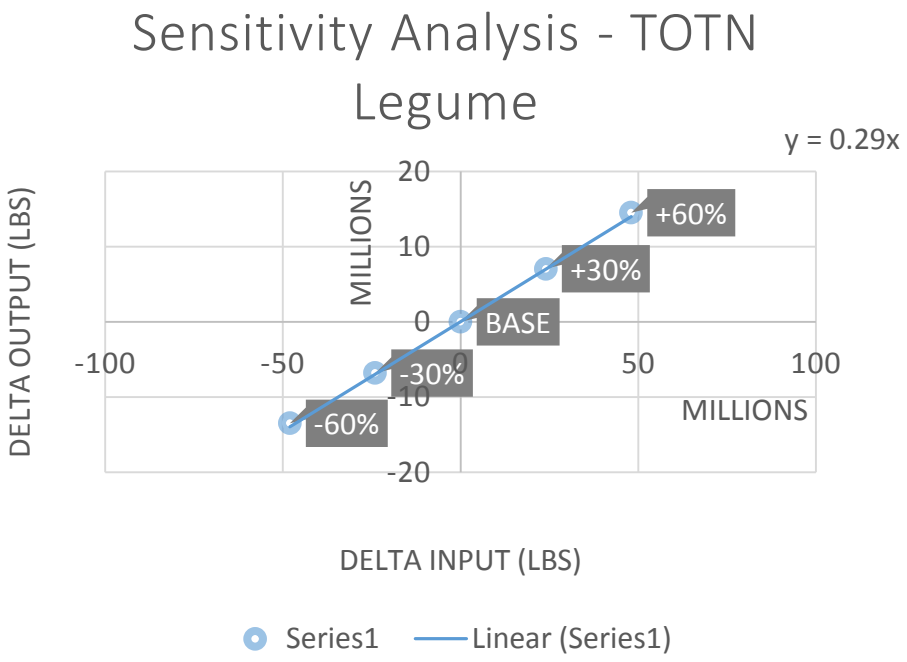
- Run all AGCHEM land uses for EOF output
  - hom hwm lwm alf for pas hyo npd
- Base scenario 1997 No Action
- Fertilizer, Manure, Atdep, Crop Uptake, Fixation, and Crop Cover (6)
- -60% -30% 0% +30% +60% (4)
- TN, NO3, NH3, and ORGN (4)
- All land segments (367)
  - 6 x 4 + 1 = 25 scenarios

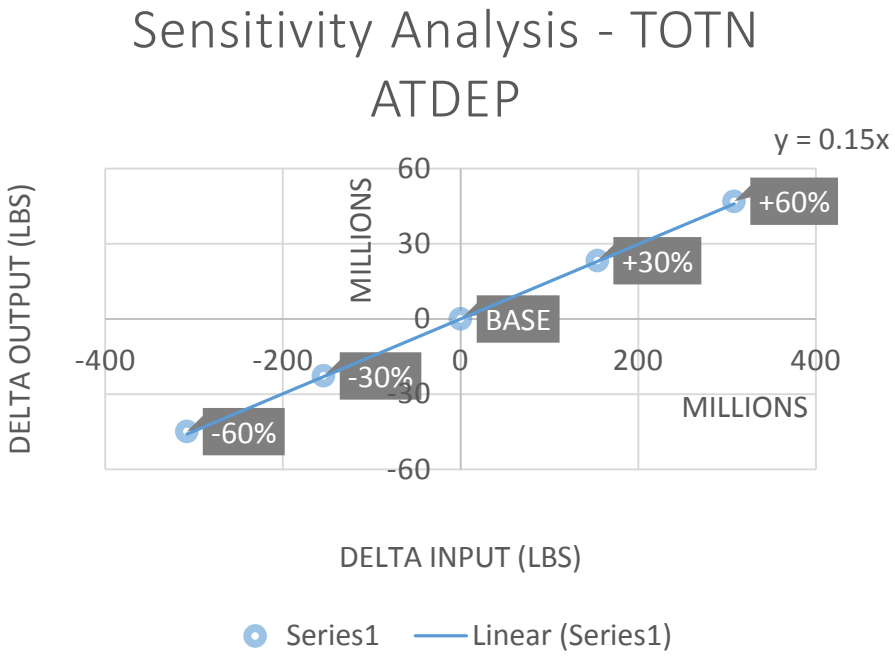
New Nitrogen Sensitivity Analysis Approach





New Nitrogen Sensitivity Analysis Approach





New Nitrogen Sensitivity Analysis Approach