

Review of the LimnoTech Report *Comparison of Load Estimates for Cultivated Cropland in the Chesapeake Bay Watershed*



*Scientific and Technical Advisory Committee
to the Chesapeake Bay Program*

November 10, 2011

The Chesapeake Bay Commission, York PA

Background

- LimnoTech (LT) compared the CBP watershed model to a new USDA model (CB-CEAP)
- LT prepared the report for the Agricultural Nutrient Policy Council (ANPC), an lobbying group representing agricultural trade organizations
- LimnoTech observed differences between the models & their results and recommended suspending implementation of the Chesapeake Bay TMDL until the differences can be resolved
- LT's report has been cited in the popular press, legislative testimony, and in lawsuits to stop TMDL implementation

STAC review

- The Chesapeake Bay Partnership asked STAC to convene an independent review panel
- The review panel included STAC members and external experts from state universities (UMD, VT, VIMS, PSU) and national research organizations (USGS, SI)
- The lead developers of the CBP and USDA models met with the review committee

Review questions

- Are LT analysis & recommendations based on reasonable expectations for models and differences between models?
- Does LT report accurately present the two models & their results (are the facts right)?
- What activities can improve application of multiple models in the Chesapeake Bay watershed?

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Reasonable model expectations (from modeling science & NRC reports)

- Models are essential for complex accounting & scenario analysis
- All models are imperfect and incomplete
- Model complexity is limited
- Simplifications & approximations are always needed
- Compromises driven by goals, available data, & modeling resources
- We expect differences between models, especially models with different goals

False expectations (LT)

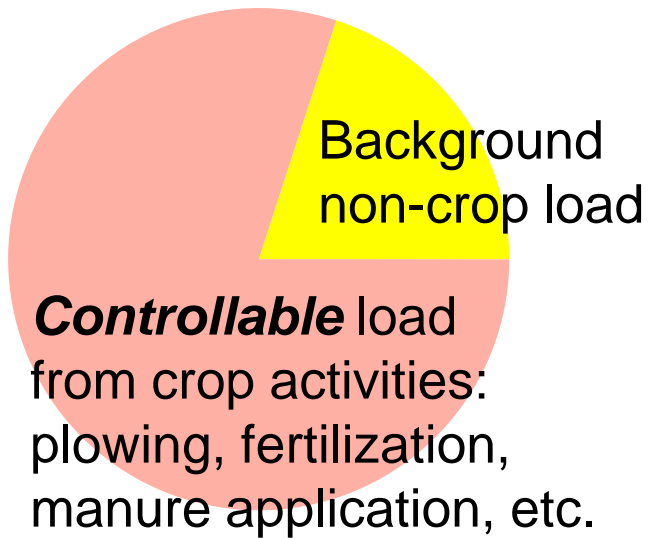
- Must ensure that the CBP model is “correct”
- Models should use the same input data, assumptions, hydrological algorithms, model frameworks
- Differences between models must be “resolved” before TMDL is implemented
- The TMDL requires “single pound” accuracy and precision

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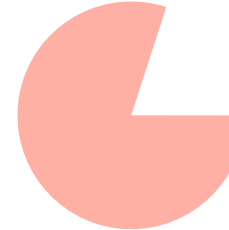
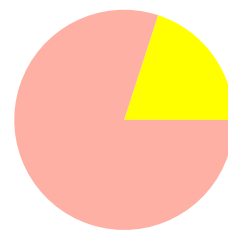
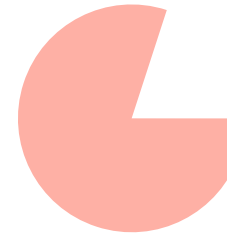
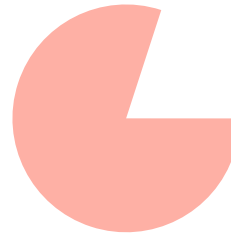
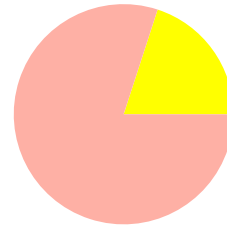
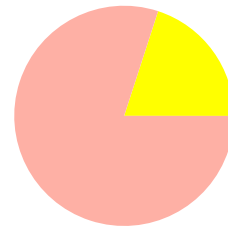
Load comparison errors

Total crop load



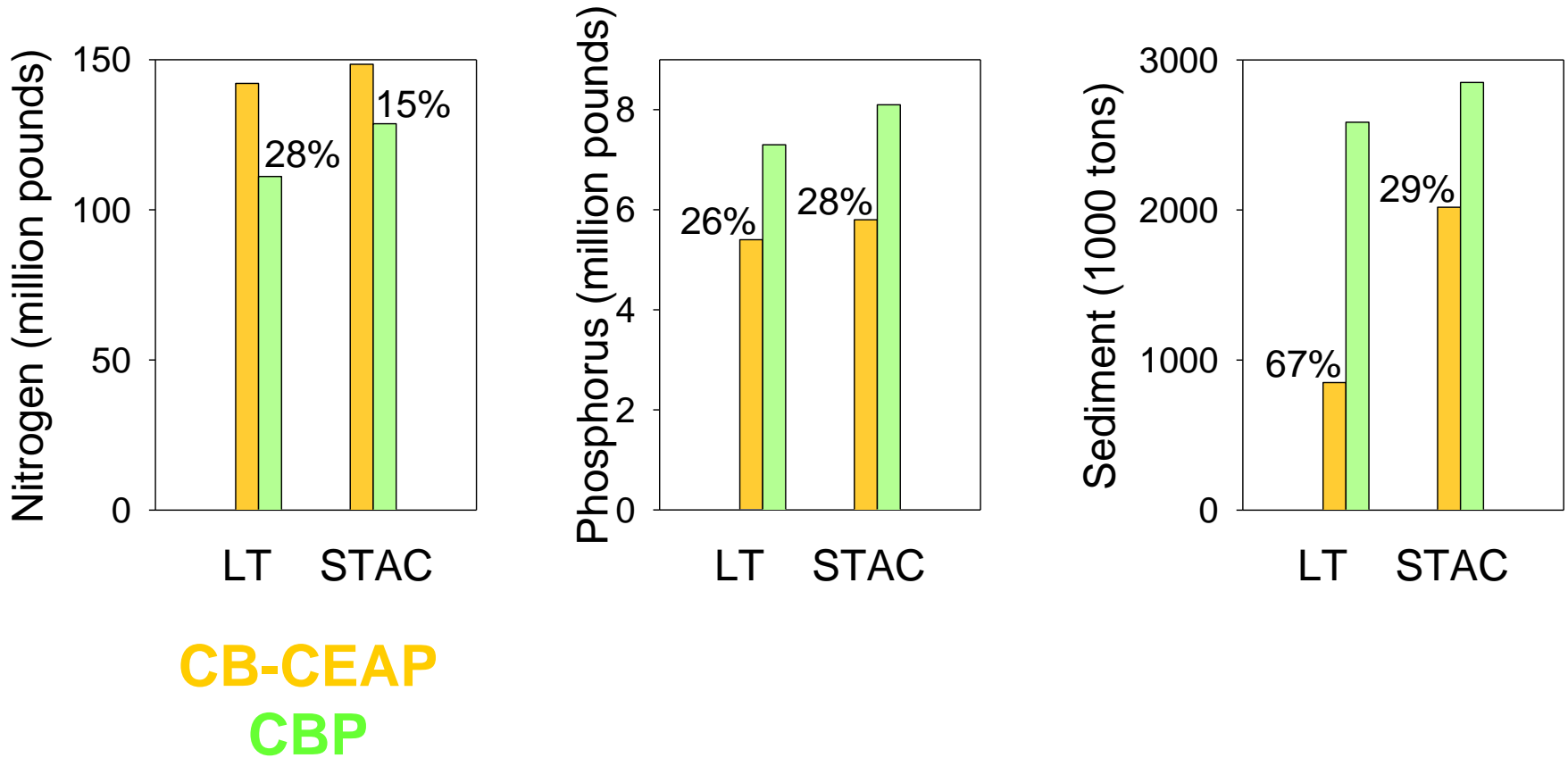
Possible comparisons

CBP CB-CEAP



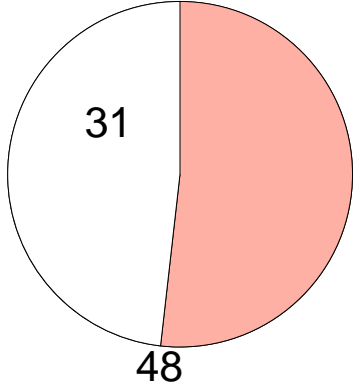
CBP 2005 loads (not 2009) compare to CB-CEAP 2003-2006

Corrected load comparison

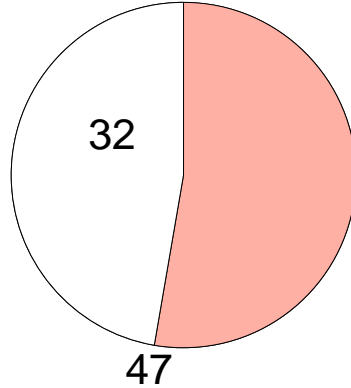


Percentages from agriculture

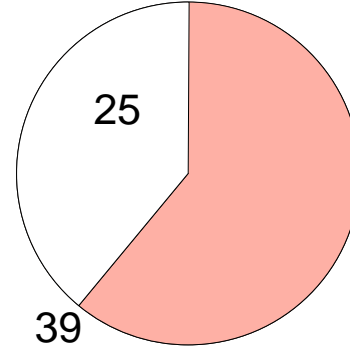
CB-CEAP N



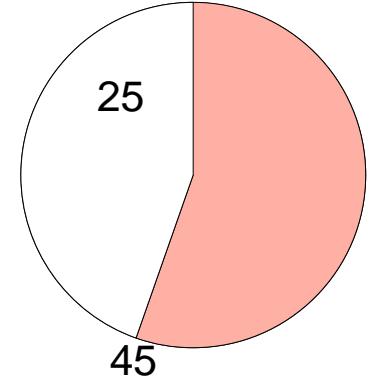
CBP N



CB-CEAP P



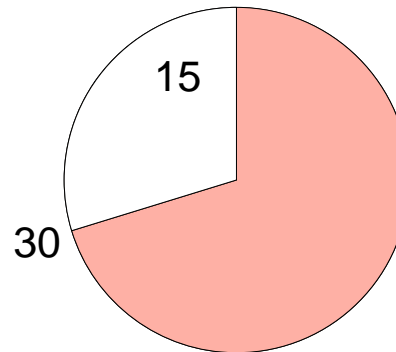
CBP P



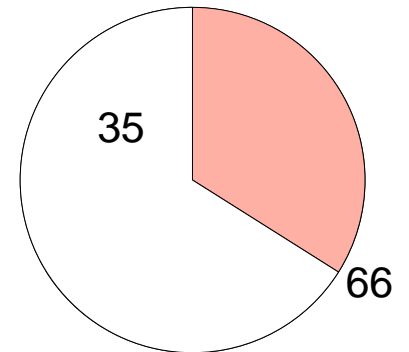
Crop

Other agricultural

CB-CEAP Sed



CBP Sed



Findings

- LT analyses have poor scientific merit and promote false standards by which to judge the suitability of the CBP model
 - Unrealistic standards for watershed model performance
 - Inappropriate expectations for agreement between models developed for different objectives
 - Errors interpreting model results

Findings

- LT failed to acknowledge that fundamental differences between models (input data, assumptions, and process representations) are unavoidable because of different objectives and differences in the data and resources available

Findings

- When errors in interpretation of model results are corrected, the model results are more similar than reported by LT
- Revised predicted loads are in approximate agreement despite differences in objectives, assumptions, input data, frameworks, and spatial and temporal details

Findings

- LT analysis ignores appreciable differences between the two models that all favor the continued use of the CBP model to inform and guide TMDL implementation
 - Purpose
 - History
 - Extent of calibration & validation
 - Level of spatial discretization
 - Level of stakeholder involvement in model and scenario development

Findings

- In summary, the review committee finds that LT's comparison of the CBP and CB-CEAP models is flawed and does not provide a scientific justification for suspending the Chesapeake Bay TMDL implementation.

Findings

- The CB-CEAP model and its supporting data provide valuable new knowledge that can inform and improve the CBP model and its application to the TMDL.
- The review committee commends the ongoing efforts between the CBP and USDA to compare and integrate their data and analyses, and recommends continued collaboration.

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Recommendations

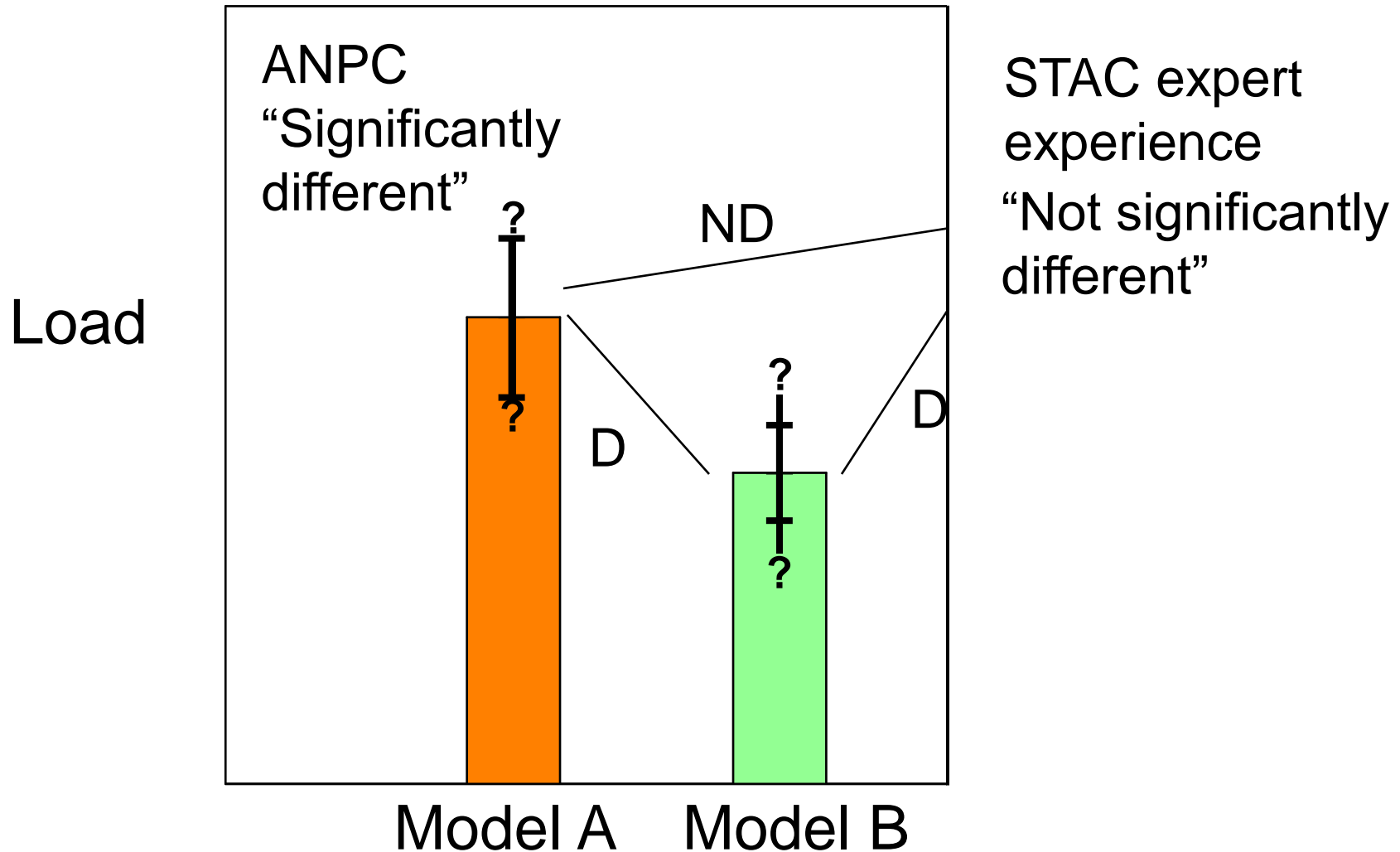
- Integrate knowledge from the CB-CEAP project into the CBP model
- Promote a realistic understanding of the uncertainties associated with watershed models through:
 - Regular peer review
 - Use of multiple models and model comparisons
 - Improved communication with the public about models, their limitations, and their uncertainties

The LimnoTech correction and ANPC press release

What is a “significant difference”

The scientific ideal

The current reality



Additional comments

- Differences between the models do not impugn the scientific basis of ***either model***
- Load predictions are inherently uncertain
- Estimating and reducing uncertainty in load predictions are at the bleeding edge of watershed model research

Closing words of wisdom

“All models are wrong, but some are useful.”

-- George E. P. Box

“The perfect is the enemy of the good.”

-- Voltaire

Link to the STAC review and subsequent Q and A:

http://www.chesapeake.org/stac/stac_rw_details.php?activity_id=201