Support for CBP Climate Change Modeling

Isabella Bertani, Gopal Bhatt, Lewis Linker, Gary Shenk

Modeling Workgroup Quarterly Meeting
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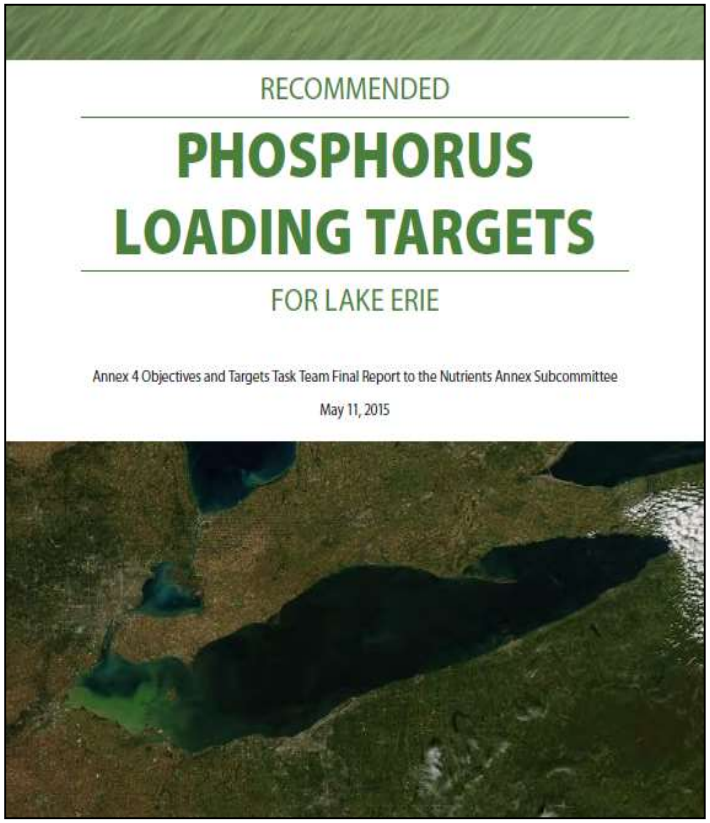
A bit about me

Freshwater ecology at Univ. of Parma

•Quantitative analysis of long-term trends in water quality and plankton community structure

Moving from Italy to Michigan...

Statistical modeling at Univ. of Michigan



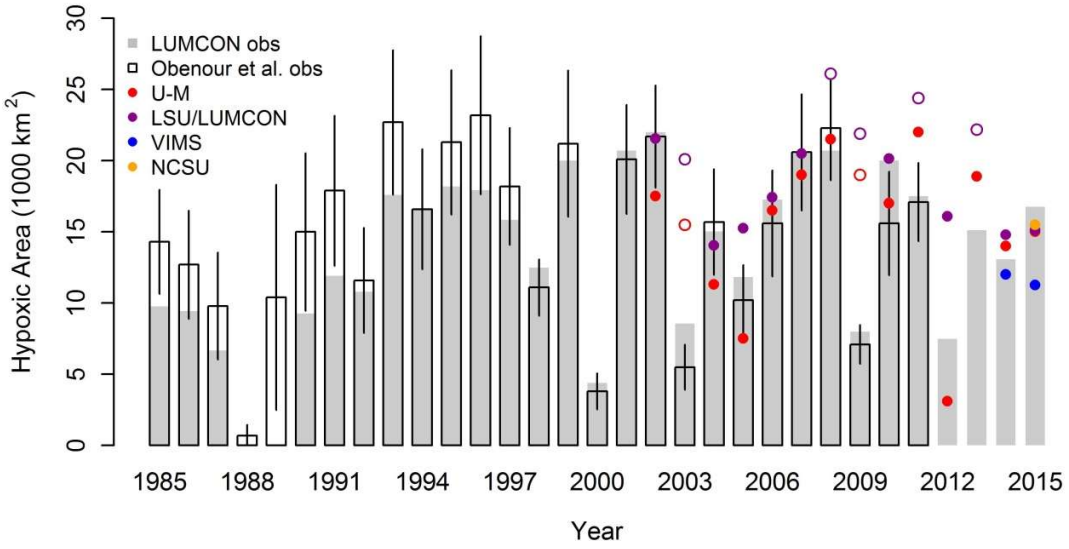
Predicting HAB size as a function of nutrient loads through Bayesian modeling

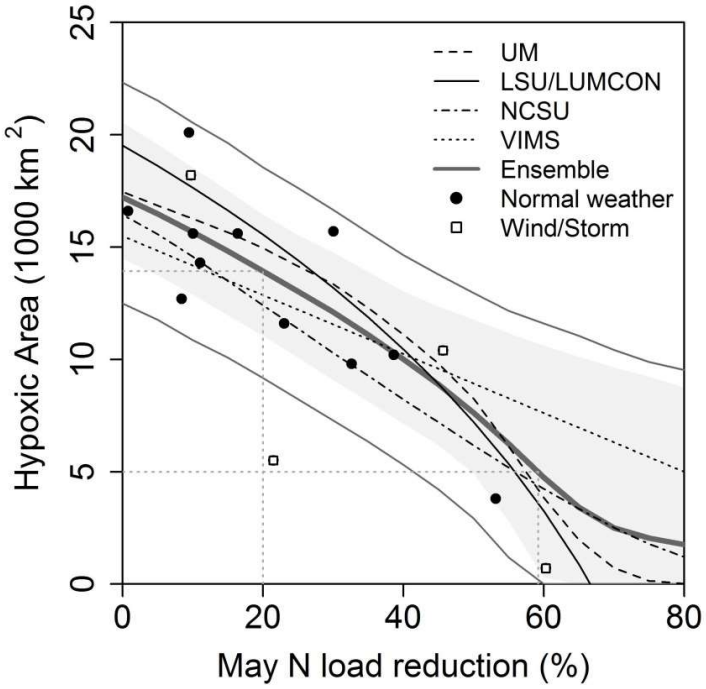
Integrating results of empirical and mechanistic models to set nutrient load targets to reduce HAB, hypoxia and excessive algal growth in Lake Erie

Comparing different HAB in-situ and remote sensing monitoring approaches to better understand uncertainty in model inputs

Statistical modeling at Univ. of Michigan

Ensemble modeling of hypoxia in the Gulf of Mexico to improve predictive uncertainty quantification





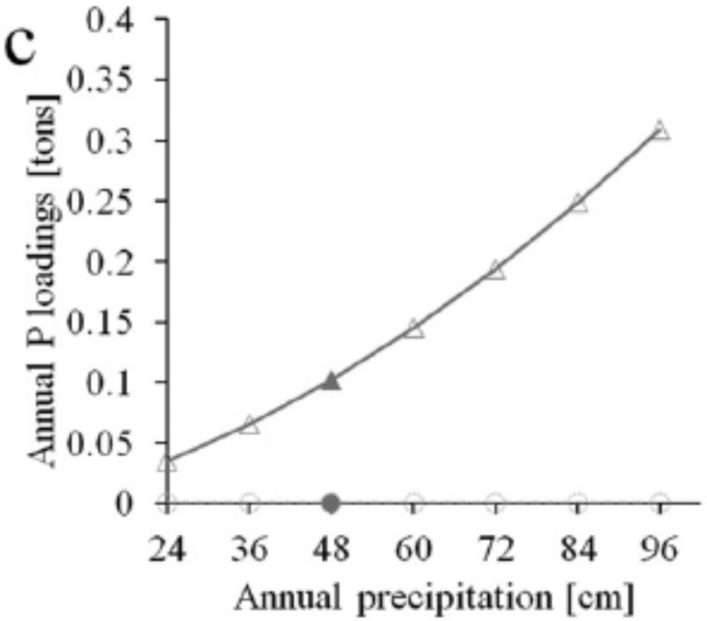
Scavia, Bertani et al. 2017

Proposed work priorities for 2019

2018 STAC Climate Change Workshop - Recommendations

*1. "**Developed area sensitivity to P.** The lack of a response of developed area phosphorus loads to climate change is not supportable, especially if climate change causes altered sediment loading from developed areas. As with nitrogen, it is suggested that the CBP address this through a literature review concentrating on published small-scale modeling efforts".*

- Review existing literature and models to quantify the sensitivity of P loads in developed land uses to climate change



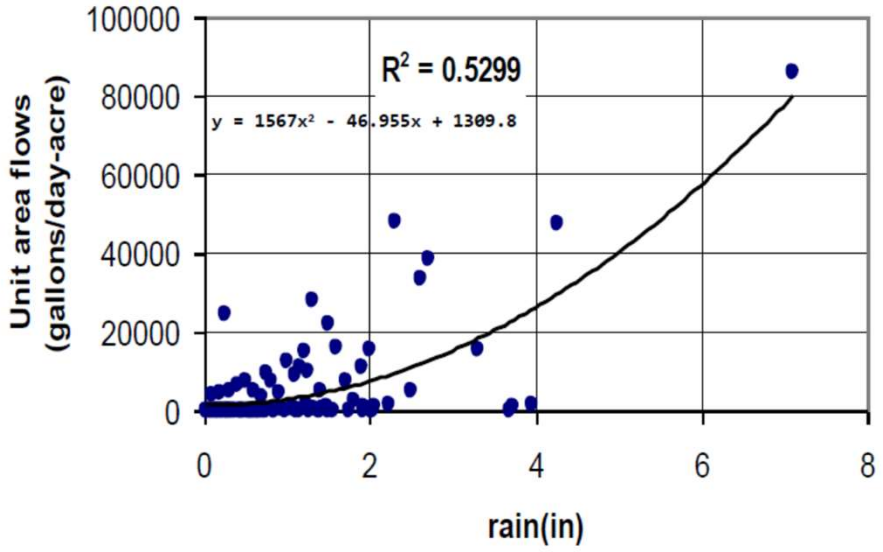
Wu and Malstrom 2015

Proposed work priorities for 2019

2018 STAC Climate Change Workshop - Recommendations

2. "Investigate potential changes to waste water overflows. *The current modeling for climate change does not consider the effect of climate on the frequency or severity of waste water overflows. In combined systems, overflows could be assessed through the existing combined sewer overflow model at the CBP".*

- Use existing regression model that relates CSO volume to rainfall to quantify changes in CSO volume under climate change scenarios



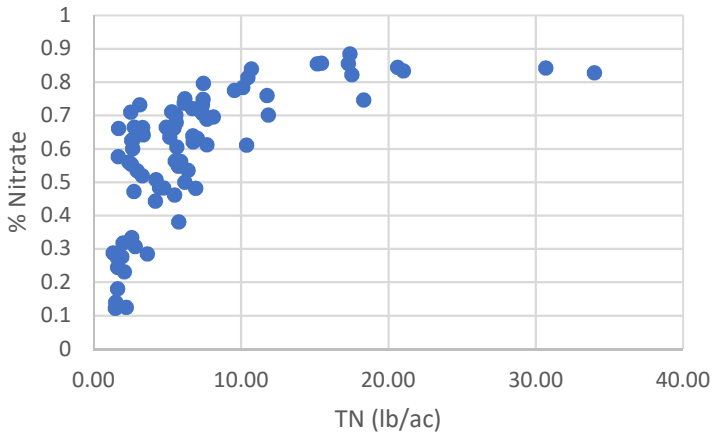
TetraTech

Proposed work priorities for 2019

2018 STAC Climate Change Workshop - Recommendations

***3. "N speciation in the P6WM** is determined by an observed relationship between total nitrogen load per acre and ratio of nitrate to total nitrogen […]. The CBP should revisit the question of changing nitrogen and phosphorus speciation as a reaction to climate change. Specifically, the CBP should investigate the complex concentration-discharge relationships in the observed record".*

- Improve quantification of climate change-driven changes in N speciation:
  - (hierarchical) modeling of long-term USGS data to understand how the observed relationship between N species and load may change over time and space
  - Review of existing literature and models to support model findings



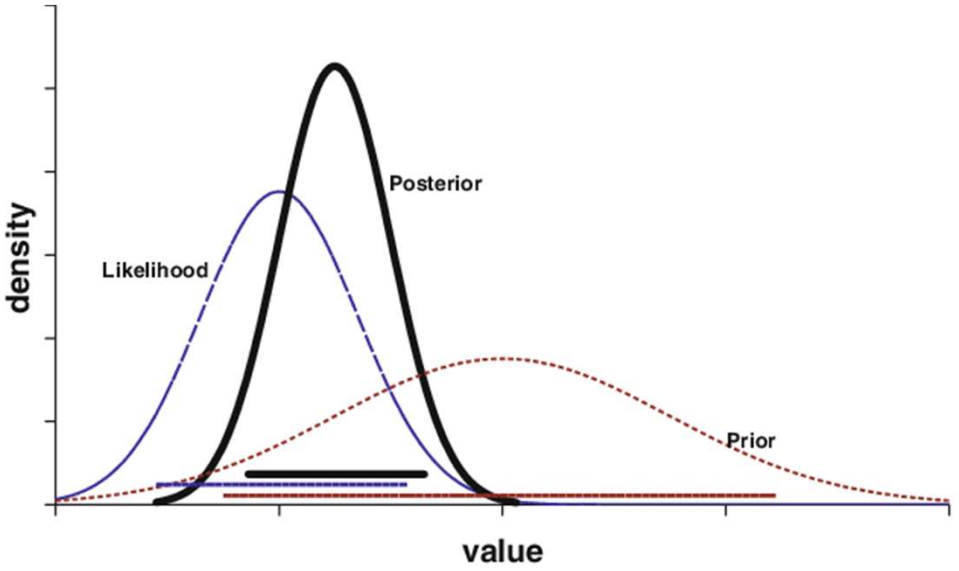
Bhatt, pers. comm.

Proposed work priorities for 2019

2018 STAC Climate Change Workshop - Recommendations

4. *"The* ***incorporation of uncertainty*** *estimation in the CBP decision making process is a frequent recommendation from STAC to the CBP (e.g. Stephenson, et al 2018). […] Climate change presents an ideal opportunity for a 'trial run' of decision making under uncertainty".*

- Develop approach to quantify uncertainty in climate change-driven inputs and propagate uncertainty through P6 model



Proposed work priorities for 2019

- Review existing literature and analyze observed monitoring data to support/inform current WSM in simulating the response of organic N and P to climate change-driven changes in flow

- Review existing literature to quantify expected changes in open ocean boundary condition temperature throughout the water column to inform the estuarine model

- Build on and improve existing Bayesian model that estimates soil P storage from APLE estimates and observed data