

A Summary of Harmful Algal Blooms and Hypoxia Forecasts for Gulf of Mexico, Chesapeake Bay, and Lake Erie

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Harmful algal blooms (HABs) and Hypoxia (low oxygen) are increasingly common problems in both marine and freshwater ecosystems. These problems are driven primarily by excess nutrient loading (e.g., phosphorus, nitrogen) from land, which is in turn driven by land-use choices and practices, wastewater treatment, and weather patterns.

HABs can contain severe toxic cyanobacteria (e.g., *Microcystis* sp., and *Anabena* sp.), and are a persistent problem in Lake Erie, and [other fresh and saltwater systems](#). In the Great Lakes, HABs usually peak from August-September, and can be harmful and even fatal to aquatic life and people.

Hypoxia is a problem in the central basin of Lake Erie, the Chesapeake Bay, the Gulf of Mexico, [and elsewhere](#). When algae die, settle to the bottom, and decay, it can reduce oxygen levels to conditions dangerous to fish.

Scientists from the University of Michigan (U-M), the University of Maryland (UMCES), North Carolina State University (NCSU), Louisiana State University (LSU/LUMCON), Virginia Institute of Marine Science (VIMS), LimnoTech, Carnegie/Stanford, and the National Oceanic and Atmospheric Administration (NOAA) developed models capable to forecast hypoxia and HABs in these three iconic systems and each year they combine efforts to release their forecasts. The U-M group is the only one contributing to all three forecasts. [See U-M contributions](#)

This Year's Forecasts

All three forecasts call for persistent HABs and hypoxia, with the Gulf of Mexico forecast for a larger than average hypoxic zone. These forecasts are also all considerably higher than the goals set for Lake Erie, the Gulf of Mexico, and the Chesapeake Bay, indicating that significant additional management actions are needed to meet those goals. Our forecast track records are at the bottom of this report.

[The Lake Erie forecast](#) comes from an ensemble of forecast models developed by U-M, NCSU, NOAA, Carnegie/Stanford, and Limnotech. The ensemble forecast called for a HAB with a severity index (SI) of 6 with a range of 5-7.5. A SI of 10 is comparable to the largest bloom on record (2011). The [U-M model](#) predicts a 31,097 metric ton HAB, with a 95% credible interval of 17,728 – 47,691 metric tons. The bloom size over the last decade (2007-2017) has averaged 22,000 MT. **As a result, this year's bloom is likely to be larger than average, and comparable to the four largest blooms on record, including the one that caused the city of Toledo to issue a “do not drink or boil” advisory in 2014. The measured 2018 HAB extent will be determined later this summer.** [See Lake Erie Forecast Release](#)

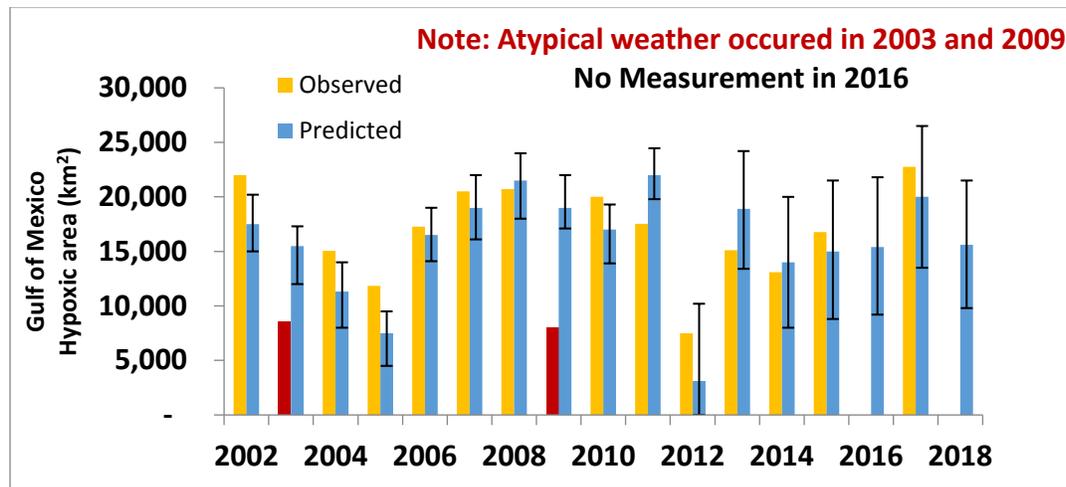
The [U-M Chesapeake Bay forecast](#) called for a hypoxic region of about 1.9 cubic miles, nearly the volume of 3.2 million Olympic-size swimming pools, which is larger than the long-term average (1.7 cubic miles) measured since 1950. The anoxic, or oxygen-free, portion of the zone is [predicted by UMCES](#) to be 0.43 cubic miles in early summer and 0.41 cubic miles by late summer. The above-average spring rainfall and streamflow transporting nitrogen to tidal waters in amounts slightly above the long-term average, according to the U.S. Geological Survey, which provides the nitrogen-loading estimates used to generate the annual hypoxia forecasts. **The hypoxic and anoxic zones remain considerably larger than the size implied by the targets set under the Chesapeake Bay Total Maximum Daily Load agreement. The hypoxic and anoxic zones measurements will be available later this summer.** [See: Chesapeake Bay Forecast Press Release](#)

[The Gulf of Mexico forecast](#) is an ensemble of forecast models developed by U-M, NCSU, LSU/LUMCON, and VIMS. The ensemble called for a hypoxic region of 5,780 square miles, an area roughly the size of Connecticut. **This is more 3 times the goal set by the intergovernmental task force in 2001.** The [U-M model](#) predicts a slightly large zone, 6,018 square miles. The long-term average dead zone is 5,209 square miles. **This year's measured extent will be made available later this summer.** [See: Gulf of Mexico Forecast Press Release](#)

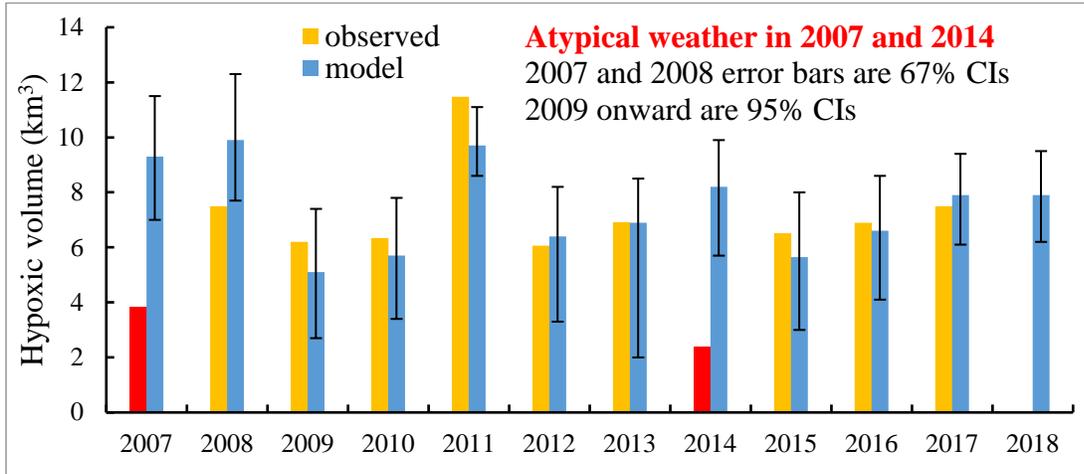
Motivation

These annual forecasts are motivated by two goals: 1) to raise public and political awareness of the policy issues driving these phenomena and 2) to test model skill and increase confidence in their use for testing policy-relevant scenarios. While the U-M Lake Erie HAB forecasts have begun only recently, our annual forecasts for the Gulf of Mexico and Chesapeake Bay began in 2002 and 2007. With the exception of years with extreme and unanticipated weather events like hurricanes and tropical storms (e.g., 2003 and 2009 in the Gulf; 2007 and 2014 in the Bay), those annual forecasts have been fairly accurate.

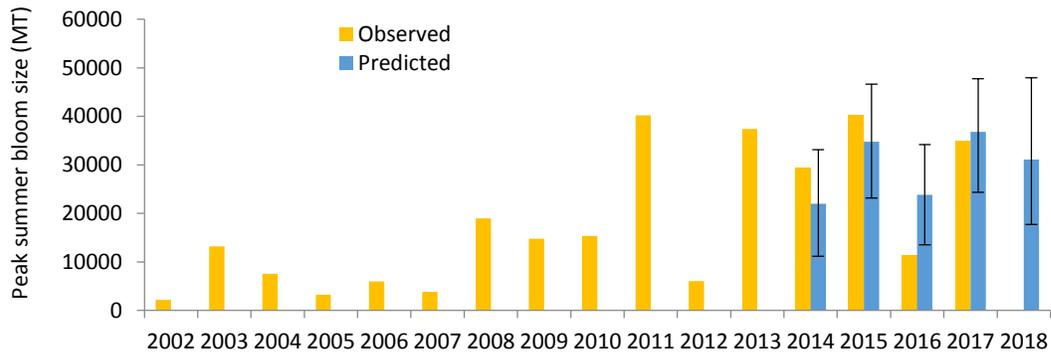
Gulf of Mexico Forecast Track Record



Chesapeake Bay Forecast Track Record



Lake Erie HAB Forecast Track Record



Contact: Don Scavia (scavia@umich.edu)

[Scavia Lab web site](#)