Tracking Harmful Algal Blooms in Western Lake Erie



Photos: (Left) Example of the optical water type classification and MODIS true color imagery. (Right two photos) Servicing of LOBO buoy.

CORE QUESTION:

How can satellite imagery and real-time weather and water data help resource managers predict and track harmful algal blooms in Lake Erie?

OVERVIEW

In recent years, the western basin of Lake Erie has experienced a rising number of harmful algal blooms. Algal blooms are driven by excess nutrients entering Lake Erie through its tributary rivers. The rivers primarily the Maumee and Detroit—carry phosphorus and nitrogen swept from urban and agricultural lands by rain and snowmelt. Weak currents in Lake Erie's western basin leave most incoming nutrients concentrated near the river mouths. When the weather warms in July-October, the excess phosphorus and nitrogen promote blooms of native algae.

Toxins produced by these blooms can bring serious consequences for human and environmental health, as well as economic activity in nearby communities. Fertilizerintensive farming practices, combined with increasingly severe storms, could drive larger, more dangerous blooms in coming years.

PROJECT DESCRIPTION

The research team will sift through historical data to understand how Lake Erie's physical characteristics affect when and where blooms occur. By looking at data recorded before and during algal blooms, the team hopes to uncover patterns or distinctive data signatures that could lead future efforts to predict HABs before they form. Variables under scrutiny include:

- Satellite imagery: Sensors on satellites can monitor bloom formation and water quality. As algal abundance, dissolved organics, and sediments vary, they cause shifts in water color, which is detected by satellite sensors. Algorithms interpret these shifts in color to generate water quality data for each pixel of an image. Researchers can also use visual properties of water to create categories, called optical water types, that can help distinguish between different water masses (for example, water entering Lake Erie from the Detroit River versus the Maumee River). The project team will determine whether optical water types are a useful tool in defining favorable bloom conditions.
- **Buoy data:** A buoy stationed in Lake Erie's western basin collected a continuous stream of water quality data in 2013 and 2014. The buoy measured phosphorus compounds, temperature, algal concentrations, and other variables. Looking for shifts in these variables before and during past algal blooms could pinpoint prime conditions for bloom formation.
- Weather readings: Wind and water currents can concentrate or disperse algal cells and incoming nutrients. Understanding meteorological conditions associated with previous algal blooms could highlight wind and water patterns that are conducive to blooms.

• River flow data: The Detroit River contributes about 80 percent of the water flowing into Lake Erie, while the Maumee River contributes about 10 percent. However, the Maumee contributes a disproportionately large percentage of Lake Erie's excess nutrients. Heavy rainfall, which often carries excess nutrients, causes a marked rise in river flow rates, or the volume and speed of water discharging from a river mouth. Comparing river flow data for the Detroit and Maumee rivers could help researchers determine the relative impact of each river on when and where blooms form.

EXPECTED OUTCOMES

The results of this research will help inform bloom monitoring and modeling programs in the Great Lakes region. Any insights into the interactions of various meteorological or hydrologic conditions could help hone computer programs that simulate, project, and track HABs. Understanding the connections between satellite imagery and on-the-ground conditions will help researchers interpret the data collected by satellite sensors. Finally, determining the relative impact of the Detroit and Maumee rivers will help target legislation and funds aimed at reducing the impact of agricultural and urban land uses on Lake Erie's water quality.

CONTACT

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Lake Erie harmful algal bloom from 2009. Photo: Tom Archer



Filtration of water samples for lab processing.





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