



NOAA / CILER Great Lakes Environmental Research Laboratory



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Lake Erie Millennium Network
Windsor, ON
April 28, 2010





Objective for Today



Exploring Opportunities

- GLERL Update
 - Facilities familiarization
 - Introduction of science personnel and science directions
 - Identify existing and potential collaborations
- NOAA in the Great Lakes
 - GLRI
- Partnering for Great Lakes Ecological Services



GLERL Infrastructure Ann Arbor



- Building completed in 2009
- Houses 97 employees – federal & university scientists, partners, contractors and students
- 54,000 total gross square feet
- 16,000 sq ft. lab space





Observing Systems: GLERL Fleet Operations



- Quality jobs – opportunities for growth
- The best platform for the mission
- On site and on time - reliability
- Maximum efficiency
- Maximum utilization
- Respond to customer requirements
- Anticipate future needs
- Assessments and benchmarks
- Life cycle management





GLERL Infrastructure Focus

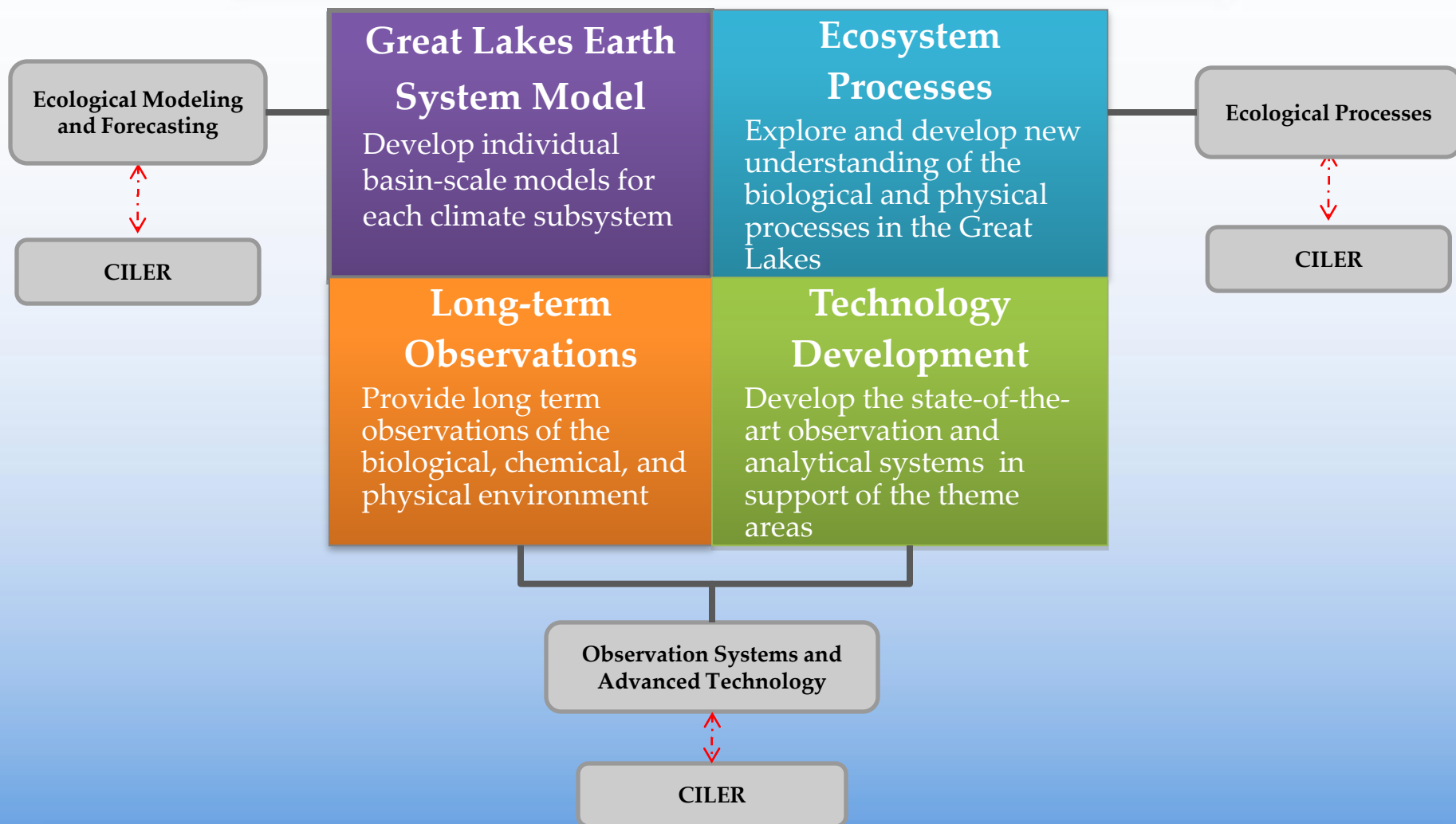


- Muskegon Building #2
- Complete Build Out in Ann Arbor
- Field and Laboratory Instrumentation





Aligning GLERL Research Themes





Great Lakes Ecological Forecasting Needs Assessment (2004)



NOAA Technical Memorandum GLERL-131

ftp://ftp.glerl.noaa.gov/publications/tech_reports/glerl-131/tm-131.pdf

- Fisheries constituents need for ecological forecasts relating to **fish stock** assessments,
- Water quality regulators, water dependent industry and utility, recreational users, coastal property owners, and land use planners need for ecological forecasts relating to **water quantity and quality** (including sediments),
- A targeted need among transportation sectors (shipping, boating and marinas) for forecasts relating to **sediment** management,
- A broad need by most user groups for ecological forecasts relating to **weather** (offshore and nearshore),
- A broadly scattered need among a variety of user groups for forecasts relating to **aquatic nuisance species**, particularly for forecasts of **abundances**,
- A broadly scattered need among a variety of user groups for forecasts relating to **socioeconomic** factors.





FY10 Science Projects

- **Lake Michigan Intensive Sampling Great Lakes Regional Research Information Network (GLRRIN)**
 - Long-term observations that will provide time-series information for tracking and predicting ecosystem change in Lake Michigan in response to stressors.
- **Great Lakes Earth System Model**
 - An integrated modeling system (Chemical, Physical, Biological) for linking regional climate change, process studies, and hypothesis testing to inform resource managers and the public.
- **Multiple Stressors in Saginaw Bay**
 - Identify management actions that will improve water quality and fish production in the Bay and restore the ecosystem services that are important to the surrounding area.
- **Great Lakes Restoration Initiative: Beach Forecasting**
 - Notify the public of expected water quality one to two days in advance thereby preventing beach closures when conditions are safe and avoiding negative local economic impacts.



Real-time Observations in 2010



- **Central Lake Erie - Drinking Water Quality**
- **Western Lake Erie – HABs, Episodic Hypoxia, Ice Studies, Monroe Public Schools Outreach**
- **Lake Michigan – Ecosystem Observations, Rip Current Warnings, Beach Forecasting**
- **Lake Huron, Saginaw Bay - Ecosystem Obs (Multi-Stress)**
- **National Marine Sanctuaries – Ecosystem Forecasting Tools, Outreach and Education, Marine Safety**
- **Observing Systems Engineering Research – Sensor/system research, sensor interoperability, HD Video for TBNMS**



Western Lake Erie Forecast Tool Development

Year-Round Observations at Light #2

- Imagery-based ice classification, HABs detection and satellite ground-truth
- HABs, Hypoxia, Ice, Earth System Modeling research
- Engineering research platforms
- Ecological Forecasting Development



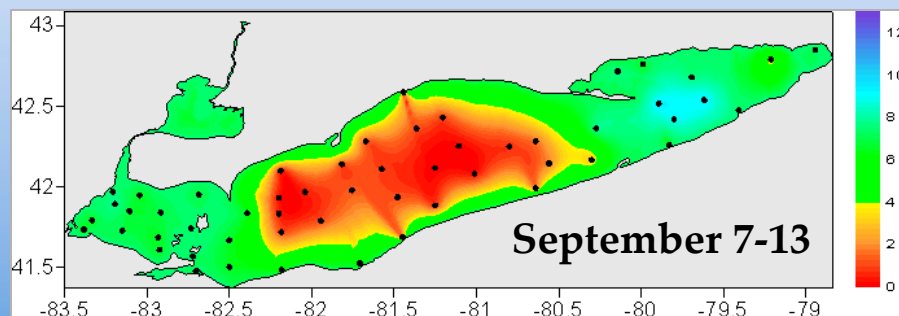
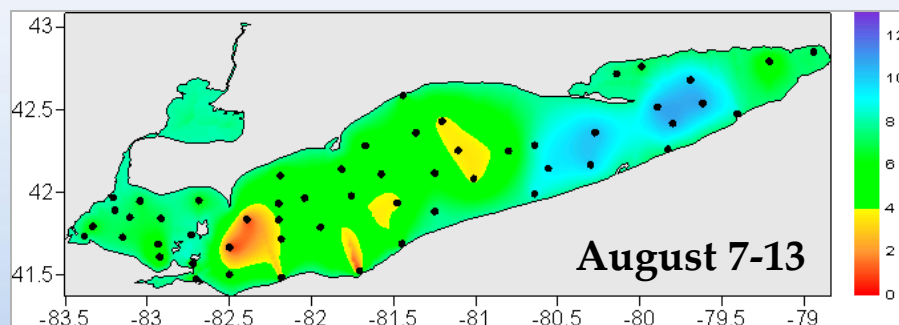
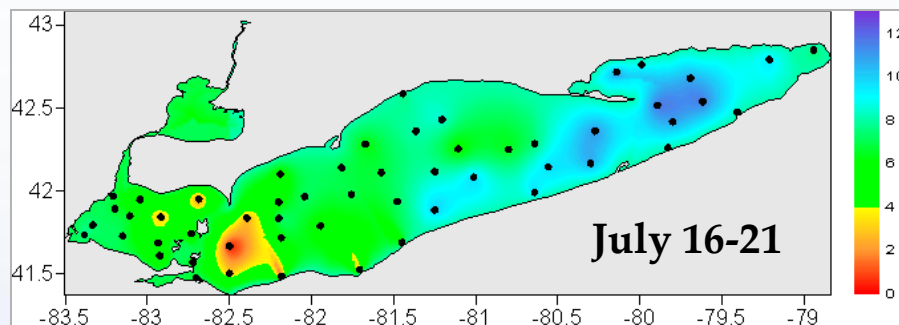
Ice Observations 2009



HABs Observations 2009



Lake Erie Hypoxia

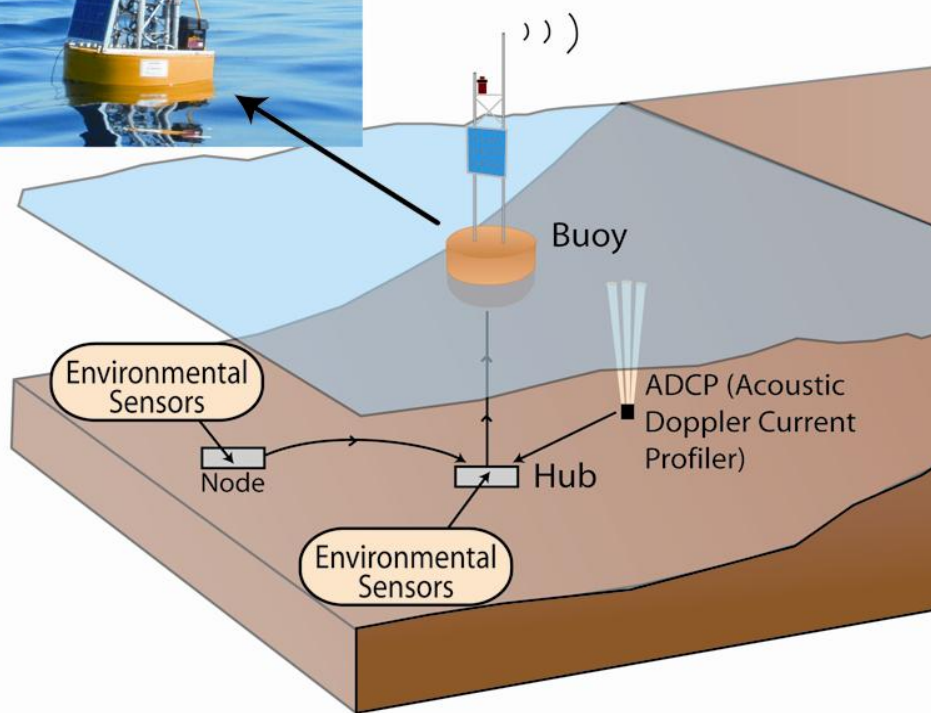
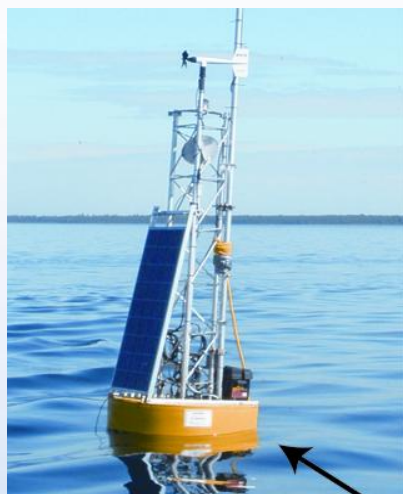


**Dissolved
Oxygen
(mg/l)**



The ReCON Concept

Successful ecosystem forecasting and forecast validation depend on the availability of data describing the present state of coastal waters at a variety of time and space scales (GLERL Science Strategy)



Shore Station

- Range from shore: 25 km
- Buoy arrays allow data relay over longer distances
- Buoy and underwater hub provide an Ethernet, Serial or Analog interface to multiple sensors
- System control allows remote power management and instrument control allowing reaction to episodic events
- Tested in temperature extremes, rain, snow, and waves (6 m)



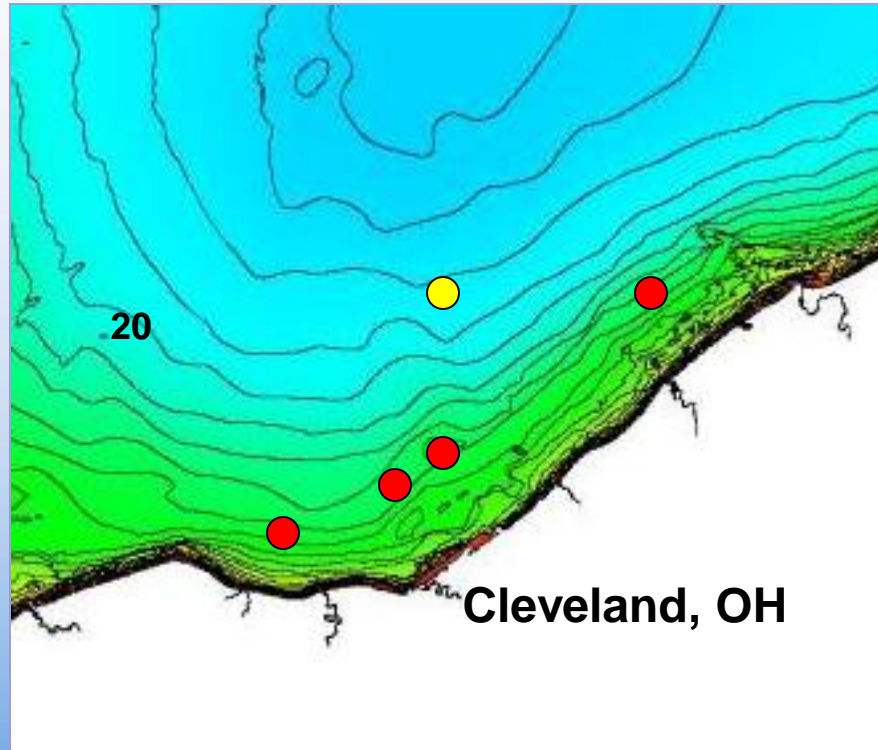
GLOS Buoy: Drinking Water Issues



Internal waves combined with hypoxic water can impact drinking water processing for about 2 million coastal residents

Real-time observations allow managers to implement alternative processing

- ReCON Buoy
- Water Intakes





ECOFORE



Assessing the causes, consequences, and potential remedies for Lake Erie hypoxia

I. Watershed Loading

Changes in nutrient loads to Lake Erie



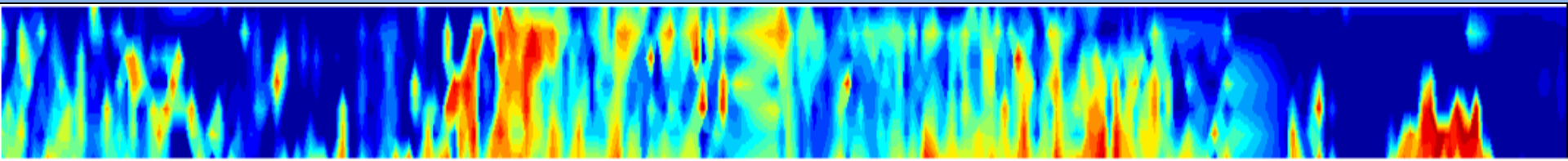
II. Hypoxia

Responses of central basin hypoxia to multiple stressors



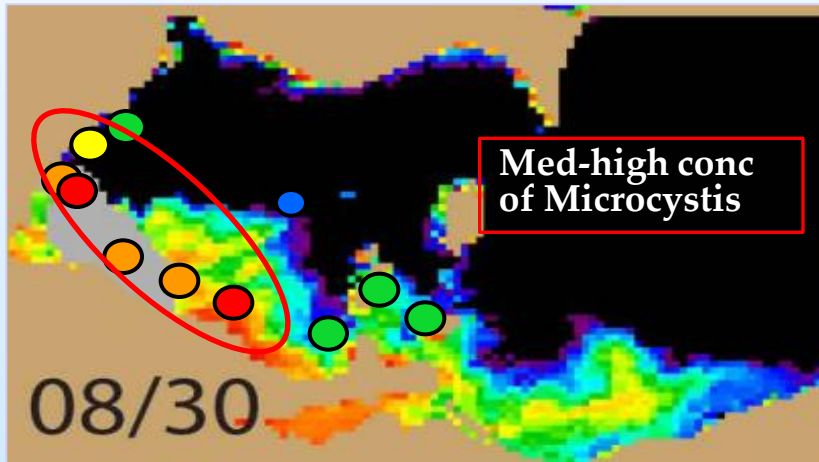
III. Ecological Effects

Potential ecological responses to changes in hypoxia



Great Lakes HAB Forecast

Detection of Microcystis bloom using MERIS data from ESA and specific cyano algorithm (Wynne et al 2008)



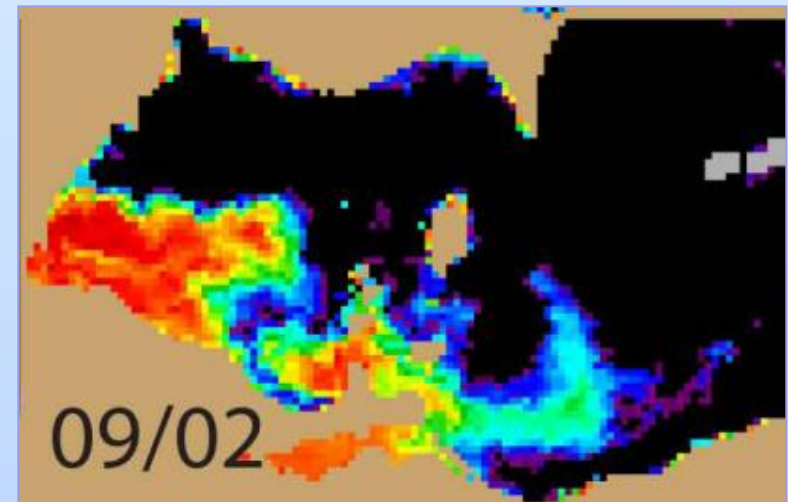
Field sampling for validation of bloom density and composition



Forecast bloom 2-4 days using particle tracking model (GNOME) and current field (Great Lakes Coastal Forecasting System)

Interpret the forecast in light of wind mixing (which can disrupt the surface bloom)

Send out HAB Bulletin to local stakeholders (health depts, beach managers, water utilities) and researchers



Experimental Lake Erie HAB Bulletin



**Experimental
Lake Erie Harmful Algal Bloom Bulletin**
2009-003
06 August 2009
National Ocean Service
Great Lakes Environmental Research Laboratory
Last bulletin: 30 July 2009

**Observed
conditions on
sampling date**

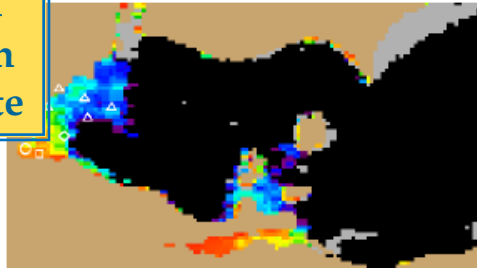


Figure 1. MERIS image from the European Space Agency. Imagery shows the spectral shape at 681 nm from August 05, where colored pixels indicate the likelihood of the last known position of the *Microcystis* spp. bloom (with red being the highest concentration). *Microcystis* spp. abundance data from August 03 shown as white squares (very high), circles (high), diamonds (medium), triangles (low), + (very low) and X (not present). Please note: Colored pixels in Sandusky Bay are due to a mixed bloom dominated by *Planktothrix* spp.

**Current conditions and
analysis of imagery**

Conditions: A *Microcystis* spp. bloom has been identified in Maumee Bay and the adjacent waters to the northeast. The bloom may be visible from the shore, or the near shore areas outside of Maumee Bay, to the east where concentrations are relatively high. A mixed bloom is also present in Sandusky Bay. Moderate taste and odor issues have been observed and may continue in Sandusky Bay as a result of the bloom.

Analysis: The *Microcystis* spp. bloom in the western basin of Lake Erie continues to increase in both area and concentration. The bloom in Sandusky Bay is a mixed bloom, primarily dominated by *Planktothrix* spp. Wind stress is expected to be low for the next several days, and will most likely intensify the bloom. The bloom is forecasted to be transported to the east over the next three days. The feature present around the South Bass Islands has not been confirmed as *Microcystis*, sampling is recommended.

-Wynne, Tomlinson

**Forecast
2-4 days ahead
of bulletin date**

**Nowcast
conditions on
date bulletin
issued**

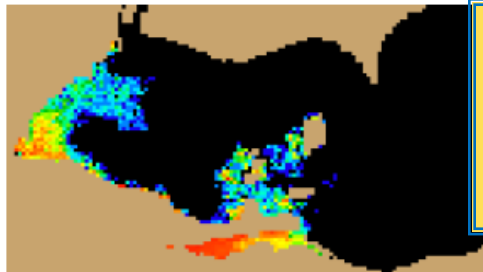


Figure 2. Nowcast position of *Microcystis* spp. bloom for August 06 using GLCFS modeled currents to move the bloom from the August 05 image. Please note: Colored pixels in Sandusky Bay are due to a mixed bloom dominated by *Planktothrix* spp.

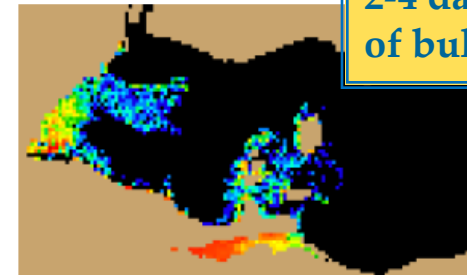


Figure 3. Forecast position of *Microcystis* spp. for August 09 using GLCFS modeled currents to move the bloom from August 05 image. Please note: Colored pixels in Sandusky Bay are due to a mixed bloom dominated by *Planktothrix* spp.

Please note:

- MERIS imagery was distributed by the NOAA CoastWatch Program and provided by the European Space Agency
- Cell counts were collected by the Great Lakes Environmental Research Laboratory
- The wind data is available through the National Data Buoy Center and the National Weather Service
- Modeled currents were provided through the Great Lakes Coastal Forecasting System

**Distributed weekly
July - October 2009**

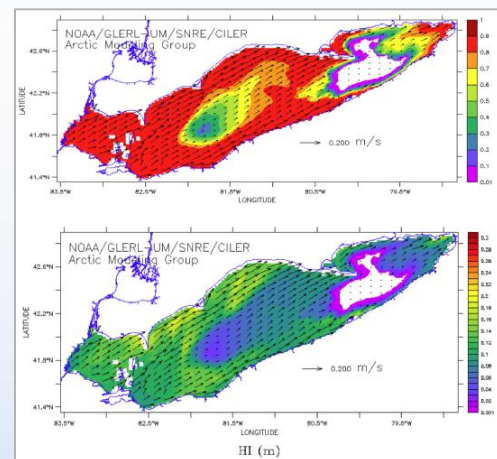


NSF Project: Modeling and Measuring Circulation and Ice in Lake Erie

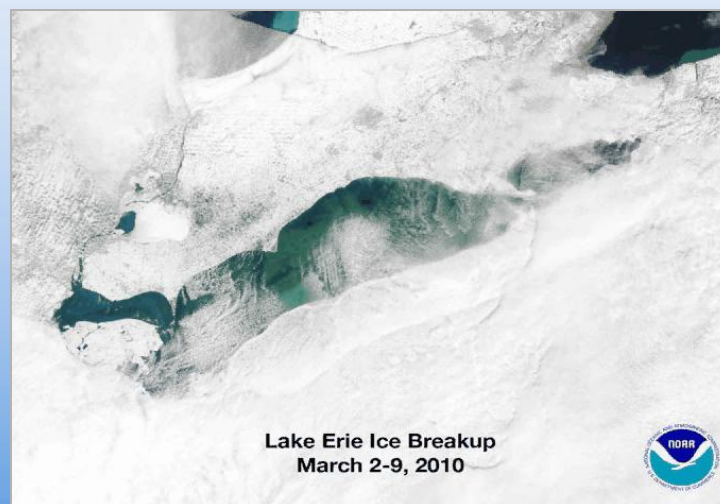


PIs: Beletsky (CILER), Hawley (NOAA), Wang (NOAA)

6 ADCPs
with ice
profilers

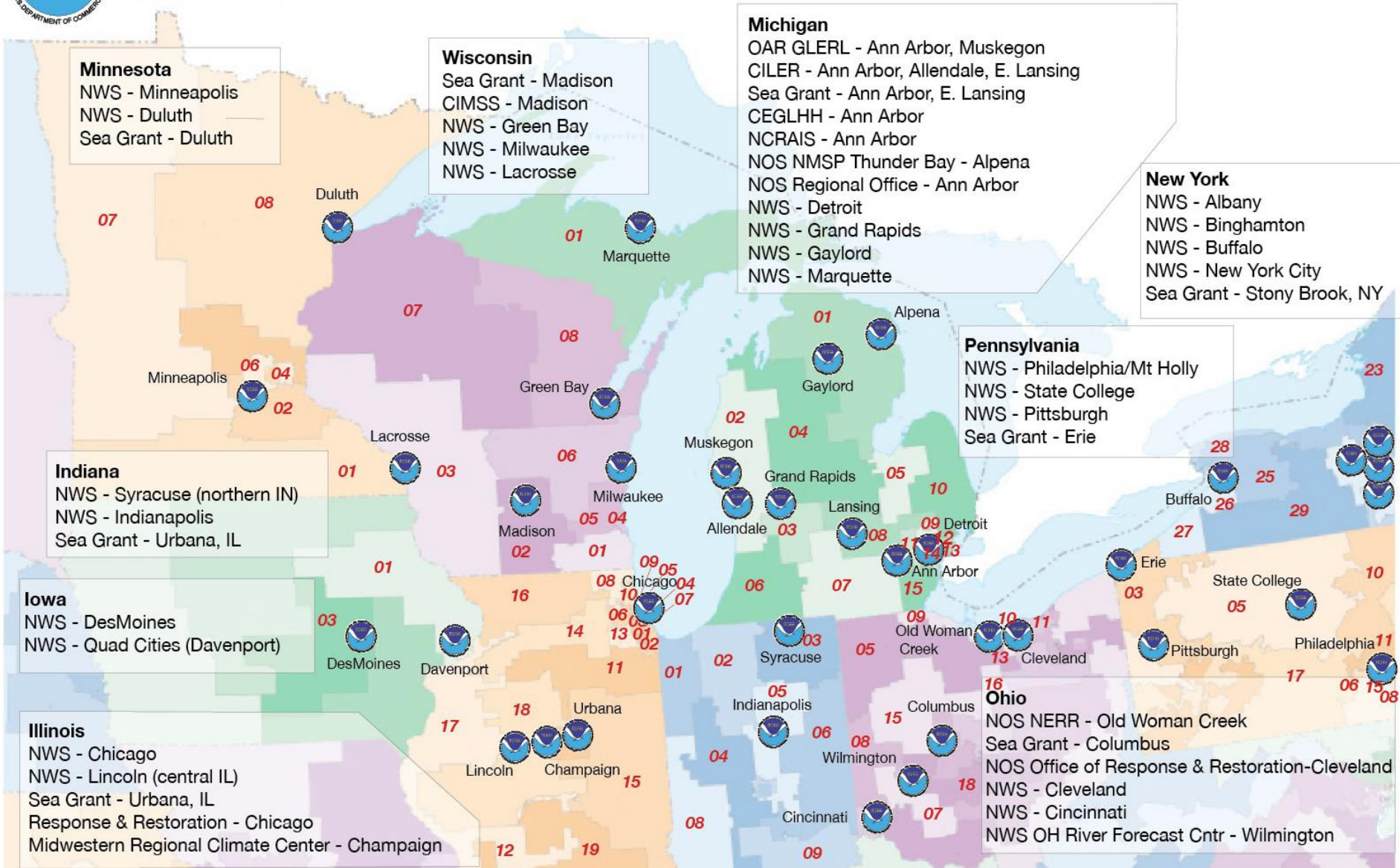


Combined
hydrodynamics/
ice model





NOAA in the Great Lakes- Freshwater, Coasts & Climate

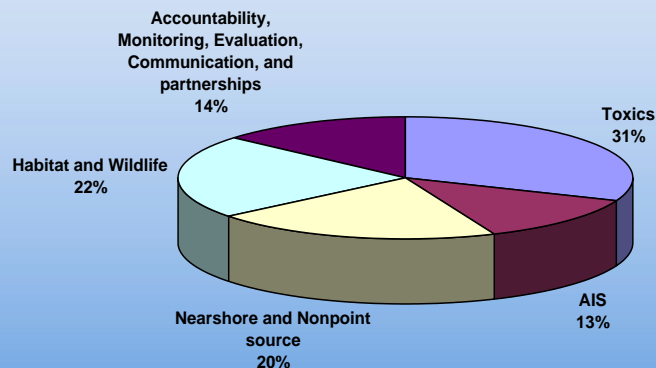


Great Lakes Restoration Initiative



FY 2010 -- \$475 million is divided in three ways:

- Funding for EPA Great Lakes National Program Office
 - Funding for 16 federal agencies
 - Funding for other public and private activity through grants
- In April 2009 **\$29.72 million** was awarded to NOAA programs
 - NOAA received the most of proportionate funding for **Habitat (19%)** and **Accountability, etc (32%)**





Working With Partners for Change: NOAA Thunder Bay National Marine Sanctuary



Alpena, MI



- Largest NOAA interpretive facility in the Great Lakes region
- Serving as NOAA field station for all types of Great Lakes research
- Sharing resources and personnel (buoys, boats, divers)
- Bringing the shipwreck experience to the shore through telepresence
- Office of National Marine Sanctuaries considering new sanctuary in Wisconsin





Coordinated Programs Working as Change Agents: National Center for Research in Aquatic Invasive Species



"Information sharing is a key priority"

- Established June 2003 to provide a central focus for aquatic invasive species within NOAA
- Research arm of the NOAA Aquatic Invasive Species Program
- AIS are threats to:
Ecosystem stability
Economic well-being
Human health

Recent aquatic invaders
into the Great Lakes



Round Goby



Zebra Mussels



Fish Hook Waterflea



Quagga Mussels



Working with Competitive Programs as Change Agents: NOAA Center of Excellence for Great Lakes and Human Health



The Center has brought long overdue attention to the public health issue of Harmful Algal Bloom's

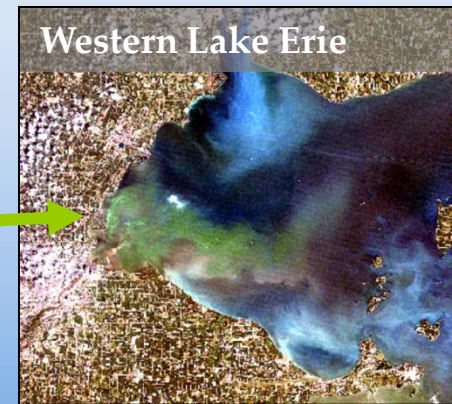
"I increase public awareness, provide training and guidance to decision makers"



Sonia Joseph, 2009
Great Lakes Sea Grant
Network Program
Award Winner

Conducts needs assessments on:

- Water Quality (e.g. drinking water)
- Beach closures
- Harmful Algal Blooms





Working with NOAA Line Office: Great Lakes Habitat Restoration Program



Because habitat degradation and loss require science-based solutions the GLHRP will:

- Create cross-NOAA Great Lakes Habitat Restoration Program office at GLERL
- Partnership approach to provide funding and technical assistance.
- Fund research and monitoring activities to address critical restoration needs and improve the science of Great Lakes restoration.

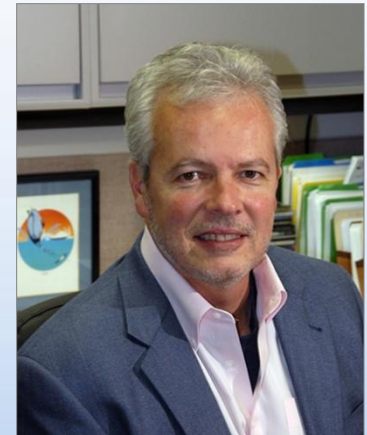




Working with Academic Partners: Cooperative Institute for Limnology and Ecosystems Research



- Established in 1989 to foster University and NOAA partnerships in the Great Lakes
- CILER has supported over 140 grants totaling over \$13,499,651. Activities under old cooperative agreement ended in 2006.
- In July 2007, new CILER was awarded to the University of Michigan as a host institution and 9 partner universities.
- Total funding for the 1st year of the agreement was \$2,020,568



Director August 2008:
Dr. Allen Burton





Working with State Partners: Sea Grant Extension at GLERL



Success Story: Collaborative Sea Grant extension agents spread!

- 3 new agents in Illinois/Indiana
- 1 new agent works with AOML & Sanctuaries Program in Florida
- 1 new GLERL agent working in Human Health Outreach

- Dr. Rochelle Sturtevant joins staff at GLERL in 2001 in a unique pilot experiment to enhance outreach and NOAA/Sea Grant connection
- Jointly funded by OAR, GLERL, and National Sea Grant Office
- Position has served as the model for additional positions in Sea Grant and NOAA





Summary



Exploring Opportunities

- GLERL Update
 - Aligning NOAA Science to support Great Lakes Ecological Services
- NOAA in the Great Lakes
 - GLRI is changing the landscape in all positive senses
- Partnerships are essential to accomplish the mission

