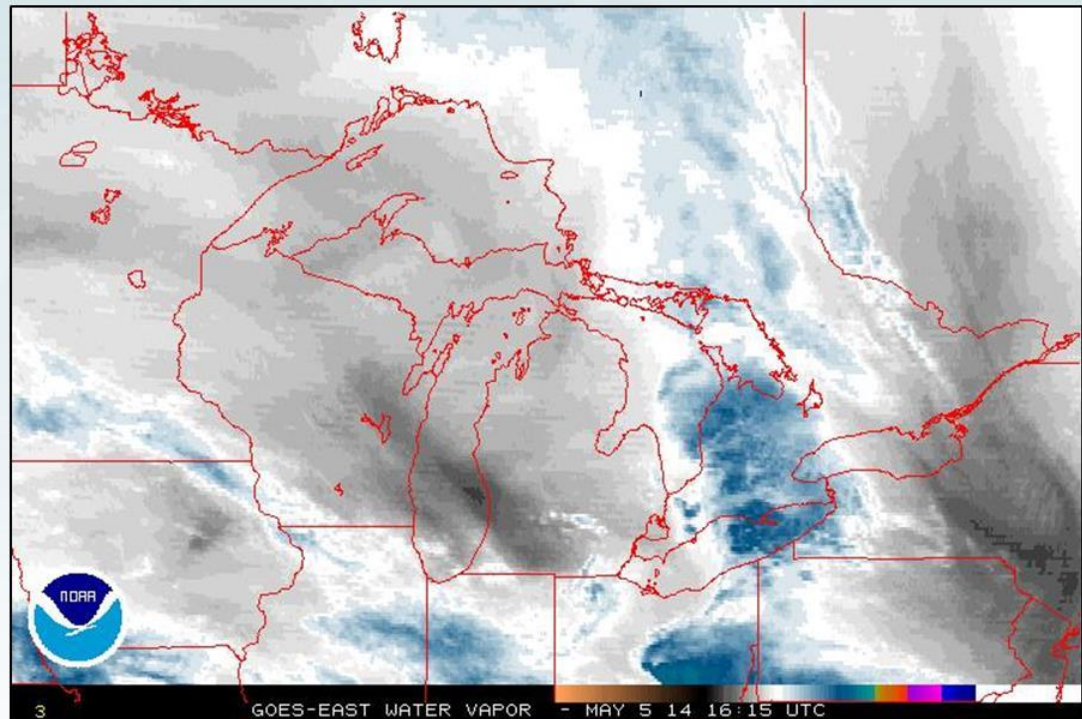




NOAA's remote sensing research in the Great Lakes

John Bratton
Acting Director

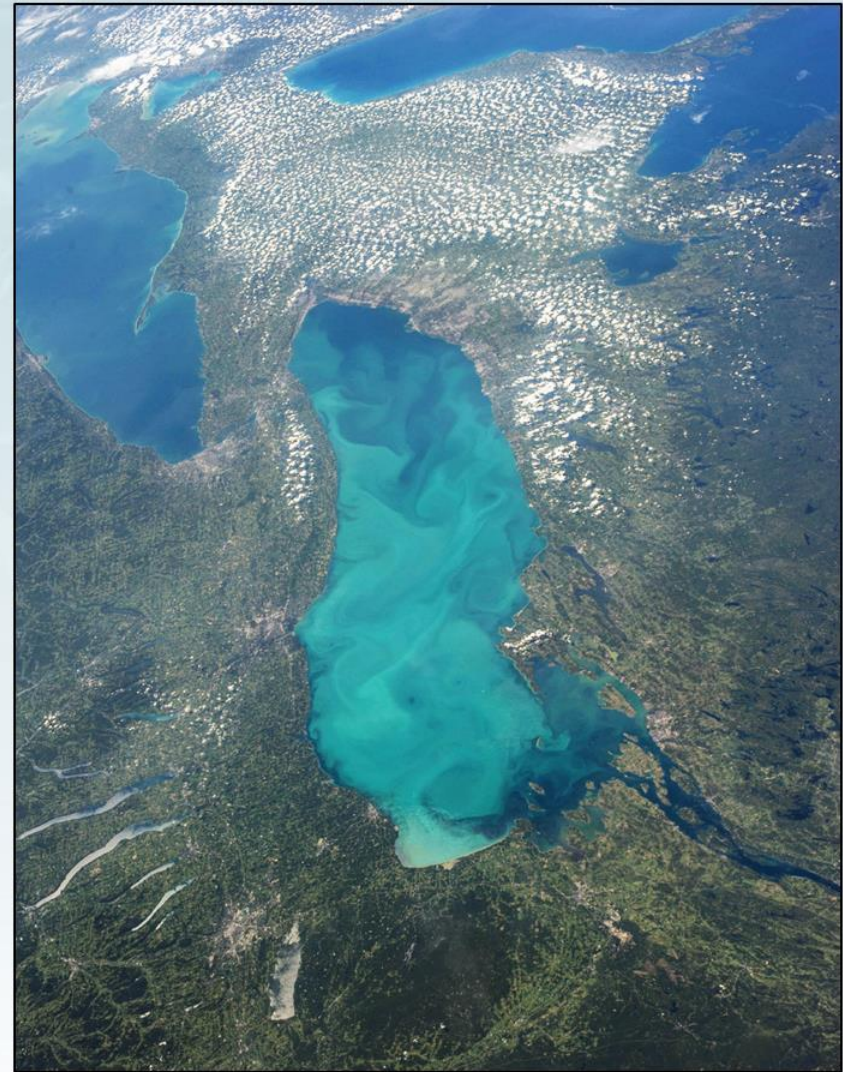
NOAA
Great Lakes Environmental
Research Laboratory
Ann Arbor, MI
May 7, 2014



NOAA RS Research and Applications



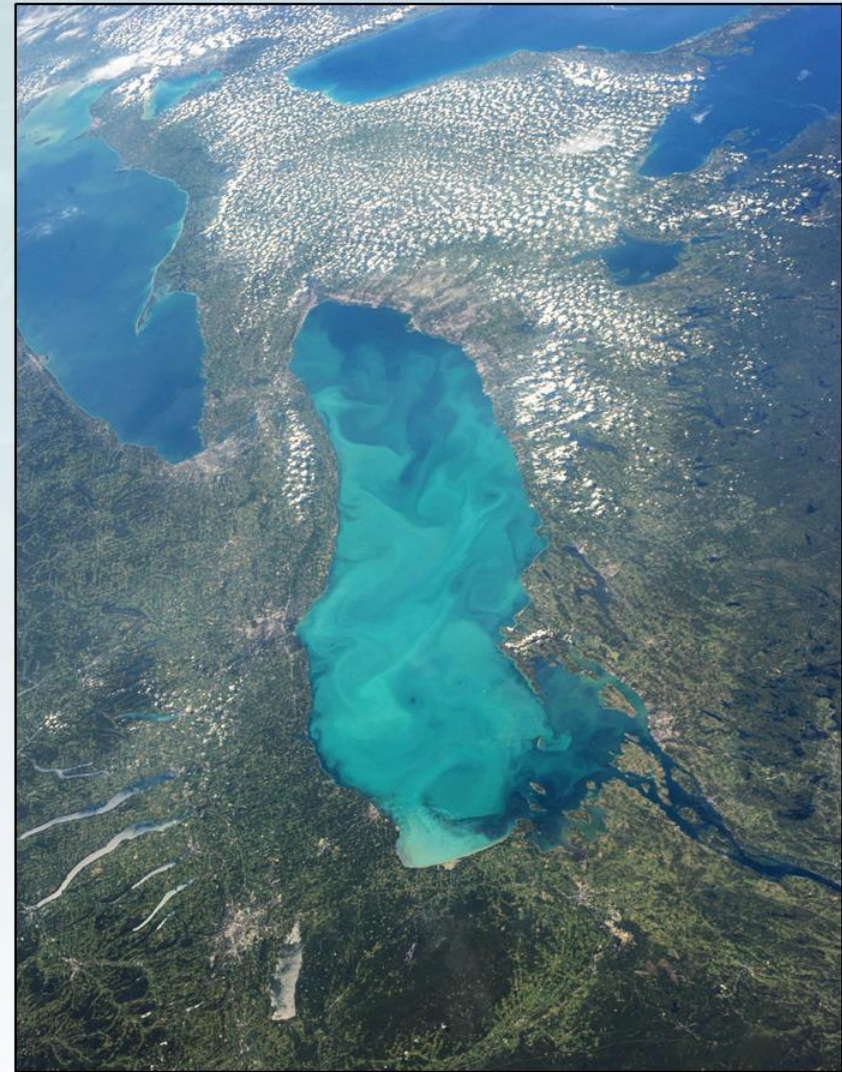
- **Aircraft**
- **Satellites**
NOAA, NASA,
ESA, CSA, etc.
- **Other**



Lake Ontario, 24 Aug 2013 (Nikon)



NOAA RS Research and Applications



Lake Ontario, 24 Aug 2013 (Nikon)

River Plume Studies



22 April 2013, Grand River plume, Lake Michigan



Photo by Marge Beaver – Photography Plus

River Plume Studies



22 April 2013, Grand River plume, Lake Michigan

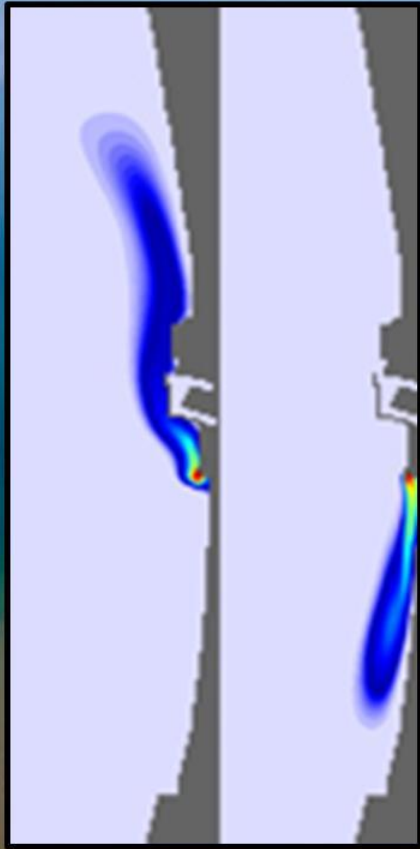
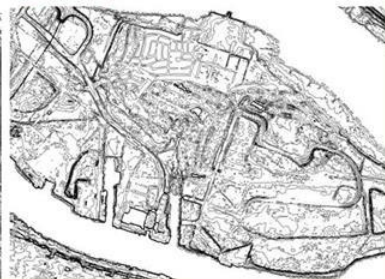
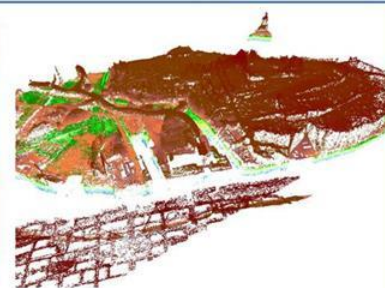
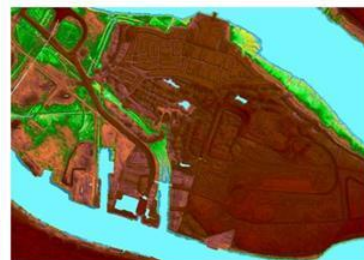
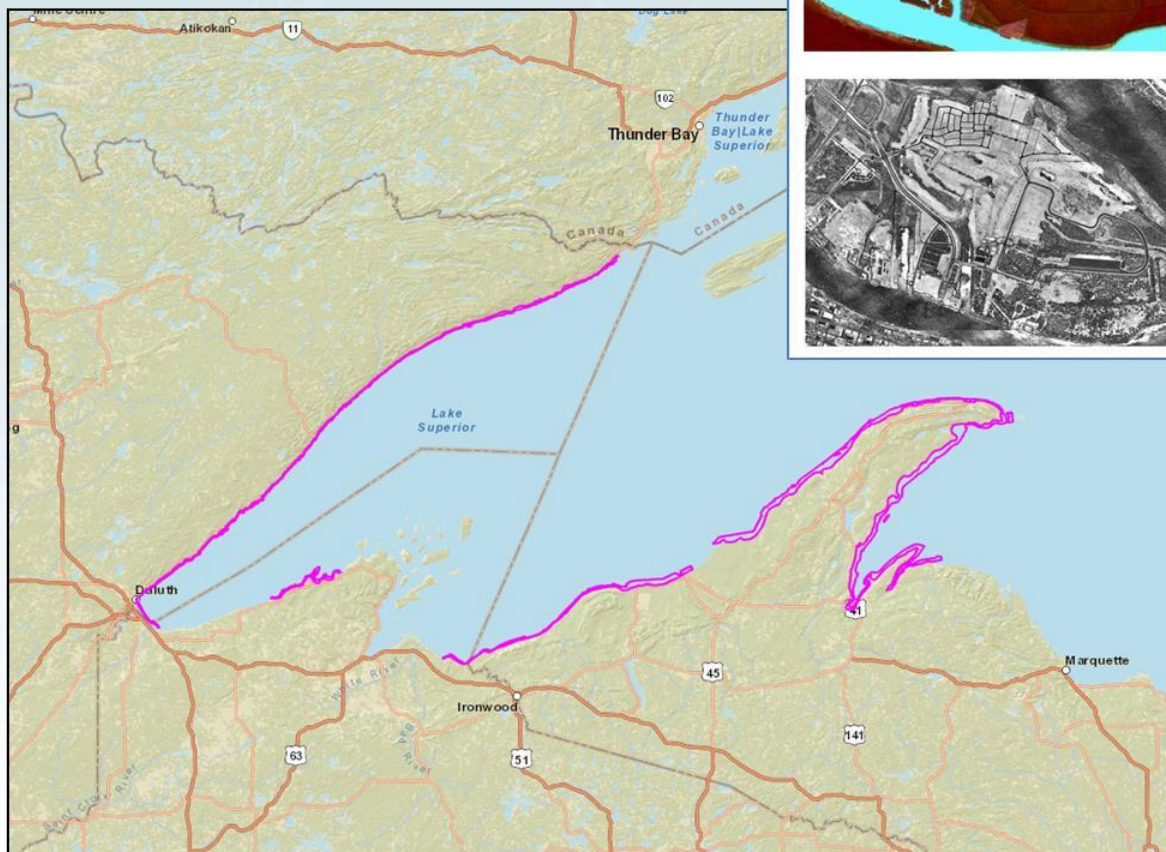


Photo by Marge Beaver – Photography Plus

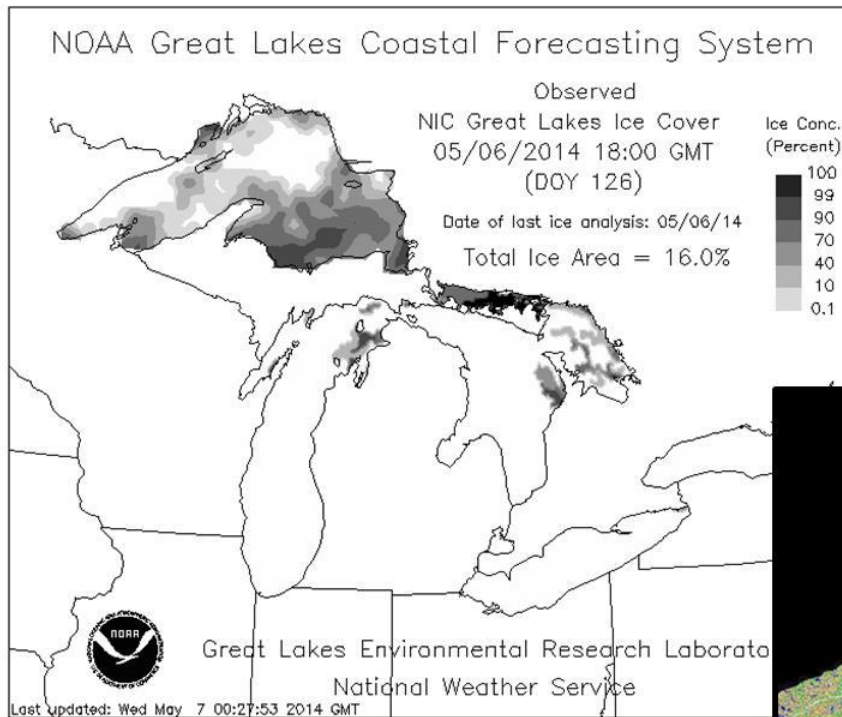
Bathymetric LIDAR



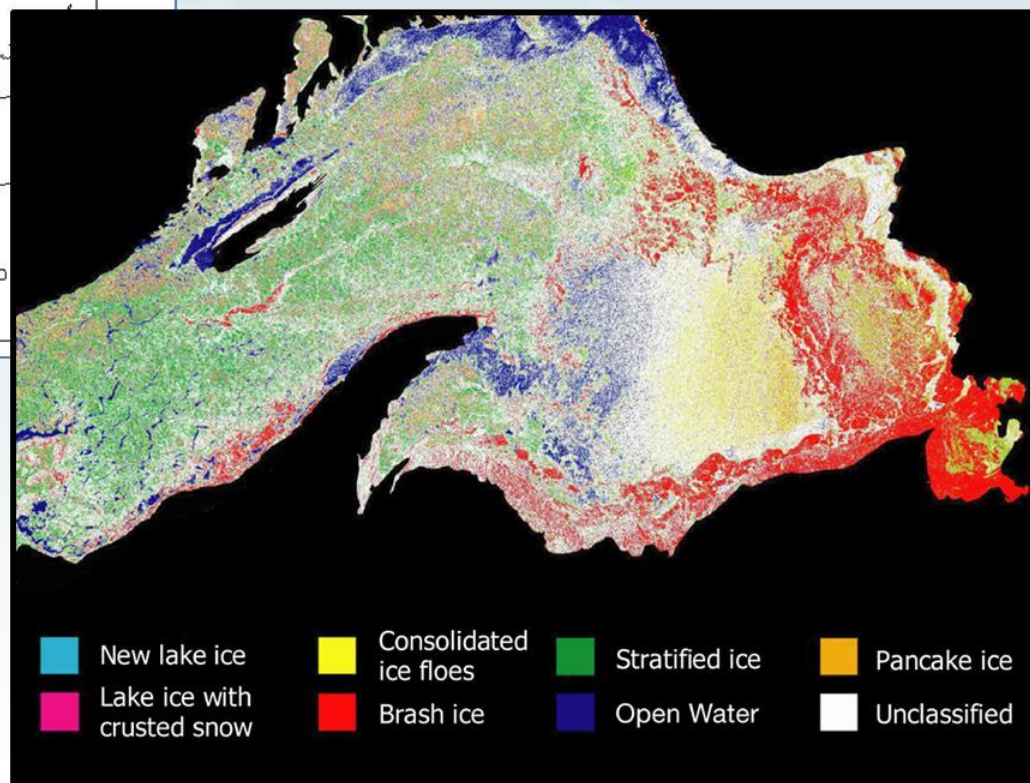
Lake Superior shallow nearshore survey



Ice cover and type



Using visual bands,
synthetic aperture
radar (SAR) and
scatterometer data



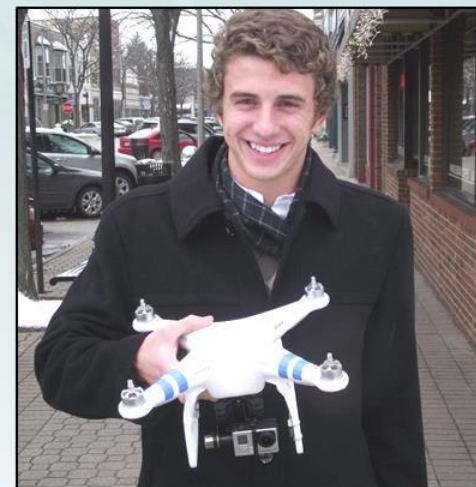
Remote Sensing by “The People”



Aerial drone catches ice images at Holland State Park



An image looking down on the channel to Lake Michigan at Holland State Park taken by a drone Jan. 12.
Contributed/Jeff Zita





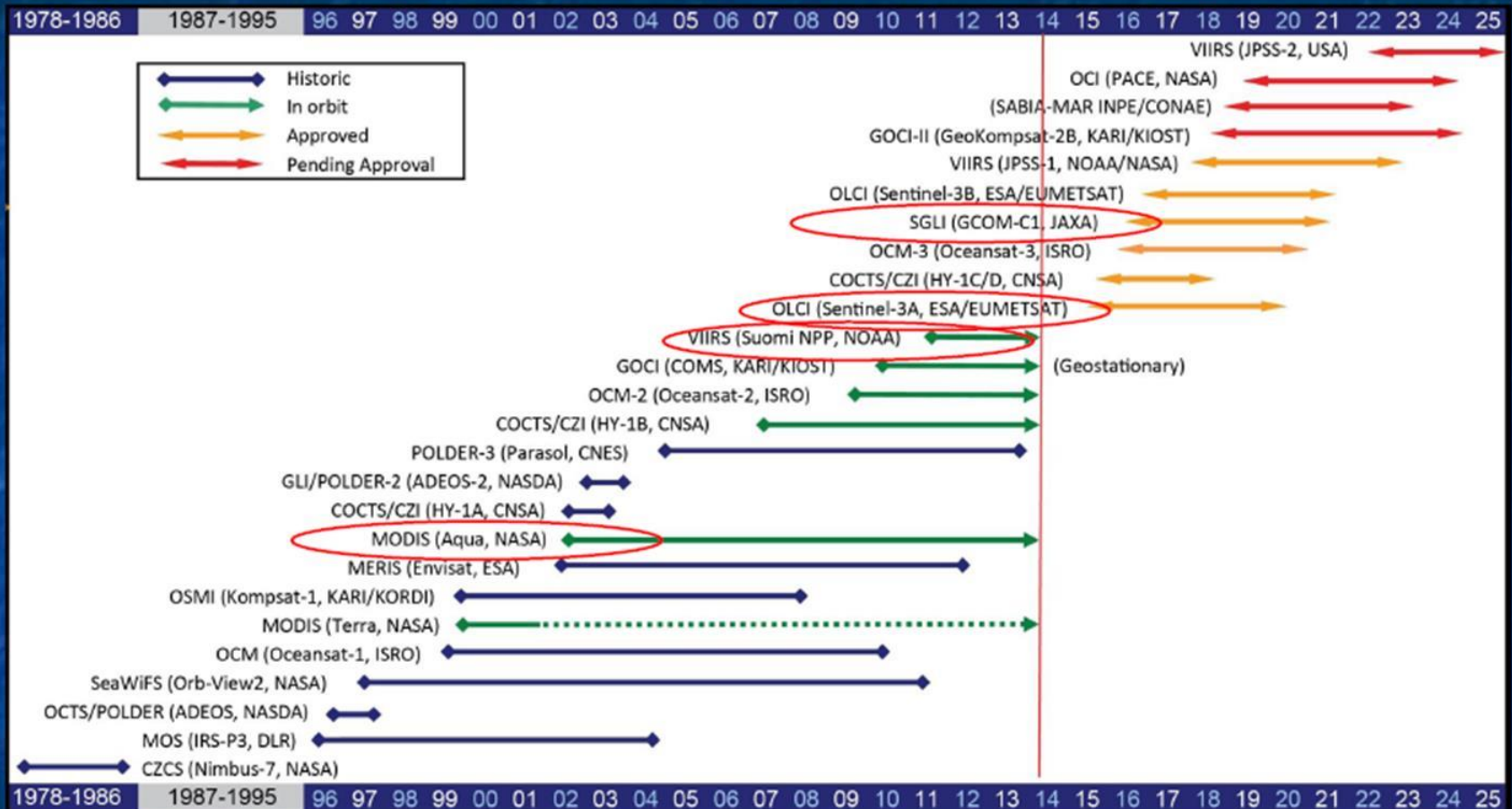
Observing Needs, Issues, Gaps and Challenges

- Users require **timely, accurate and consistent** data at regular intervals over sustained periods that adequately resolve the processes, phenomena & characteristics of interest for inland and other coastal ecosystem monitoring and management.
- The **IGOS Coastal Theme Report (IGOS, 2006)** provides a thorough overview of user needs, requirements and gaps from a coastal as well as a satellite perspective. It addresses **knowledge, resolution/coverage and knowledge** challenges.
- More specifically, satellite ocean color observations were identified in the **2007 GEOSS Water Quality Remote Sensing Workshop** as having the greatest value utility for water quality applications, but a host of supporting geophysical observations is strongly desired, e.g., surface temperature, winds, roughness, and land cover.
- Aside from issues of **cal/val and data access**, a key concern amongst users is ensuring **continuity of consistent data**, both from *in situ* and satellite sources. There are numerous systems that have already proven valuable, particularly moderate resolution ocean color (e.g. MERIS, MODIS,) and high spatial resolution imagery (e.g. Landsat, ASTER).
- That said, existing/planned satellite observing capabilities often provide **inadequate spatial, temporal and/or spectral resolution** of important biological and geophysical parameters for inland/coastal ecosystem applications, with some key measurements not presently made at all from space (e.g. estimates of river discharge).





Ocean Color Radiometry Sensors: Past, Present and Future



IOCCG, 2014 (Courtesy Venetia Stuart)

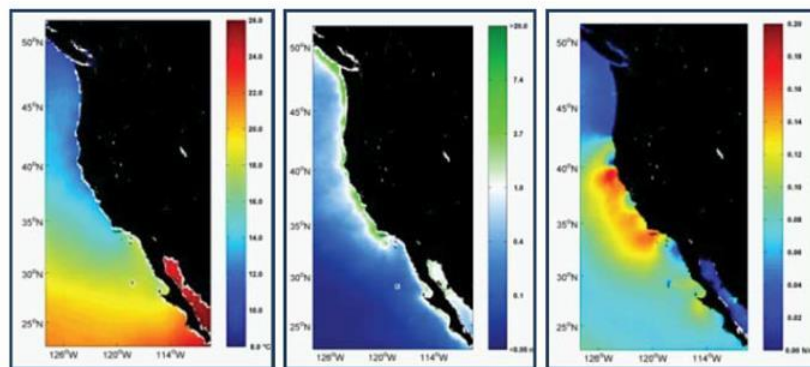


- Inter-comparison of chlorophyll algorithms
- Testing new algorithms for chlorophyll
- Defining spatial and temporal variability of blooms during the spring-fall period

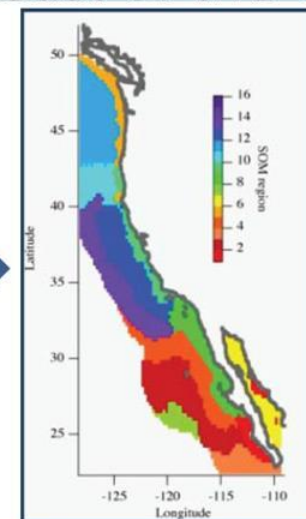


Self Organizing Maps (SOM)

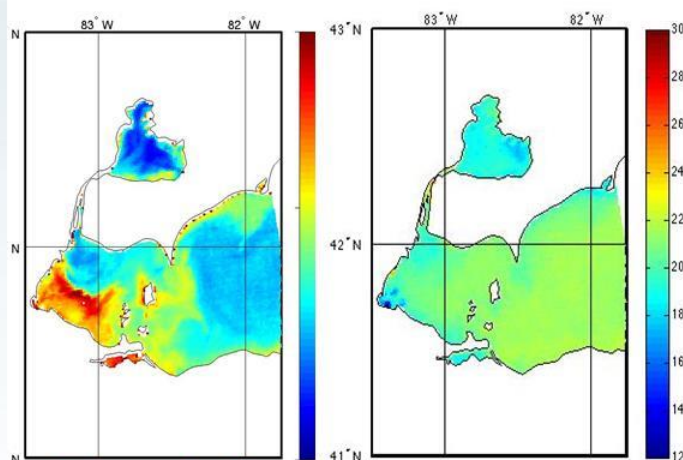
- Neural Network Approach to define biodynamic regions in Lake Erie
- Similar to past work that has been done on the west coast of the US



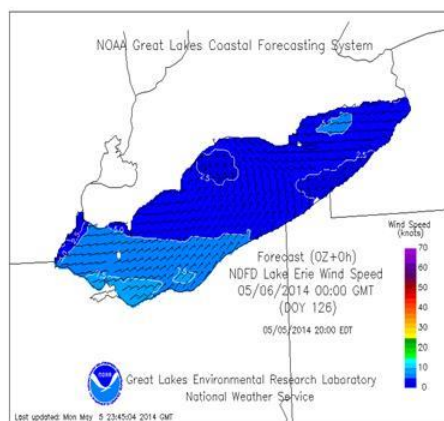
Remote sensing climatologies



SOM defines regions



Chlorophyll



Modeled winds



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Duluth: Proposed oil terminal on Lake Superior put on hold

Associated Press

POSTED: 09/22/2013 12:01:00 AM CDT | UPDATED: 8 MONTHS AGO

SUPERIOR, Wis. -- A proposed crude oil shipping terminal on Lake Superior has been put on hold, meaning oil tankers won't be sailing from the Twin Ports to the East Coast for now.

The terminal would have shipped crude from the Bakken fields in North Dakota, where production is rising so quickly that traditional means of transporting the oil to refineries are having trouble keeping up.



U.S. tries to reassure Levin, Stabenow on oil pipeline through Straits of Mackinac

2:09 PM, Jan. 8, 2014

[f Recommend](#) 280 people recommend this.



The Mackinac Bridge is shown from Mackinaw City, Mich.

Chicago Tribune

NEWS

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Home > Featured Articles > Lake Michigan

BP confirms oil spill into Lake Michigan from Whiting refinery

March 25, 2014 | By Michael Hawthorne | Tribune reporter

Less than a year after BP started up a new unit to process Canadian tar sands at its Whiting refinery, the company reported today that a malfunction allowed a slug of [crude oil](#) into Lake Michigan a few miles away from the Chicago city limits.

It remains unclear how much oil spilled into the lake or how long the discharge continued. Workers at the refinery reported an oil sheen on the water about 4:30 p.m. Monday, and an official from the U.S. [Environmental](#)



Crews cleaning up oil spill along Lake Michigan from the B...

Desired Outcomes (2012)



- A clear understanding of the **status** of remote sensing in the Great Lakes
- Establishment of a **core working group** to draft a Regional Remote Sensing **Plan** for the Great Lakes
- Publishable workshop summary **report**





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Commentary

Developing a Great Lakes remote sensing community

Marie C. Colton

NOAA Great Lakes Environmental Research Lab, Ann Arbor, MI, USA

ARTICLE INFO

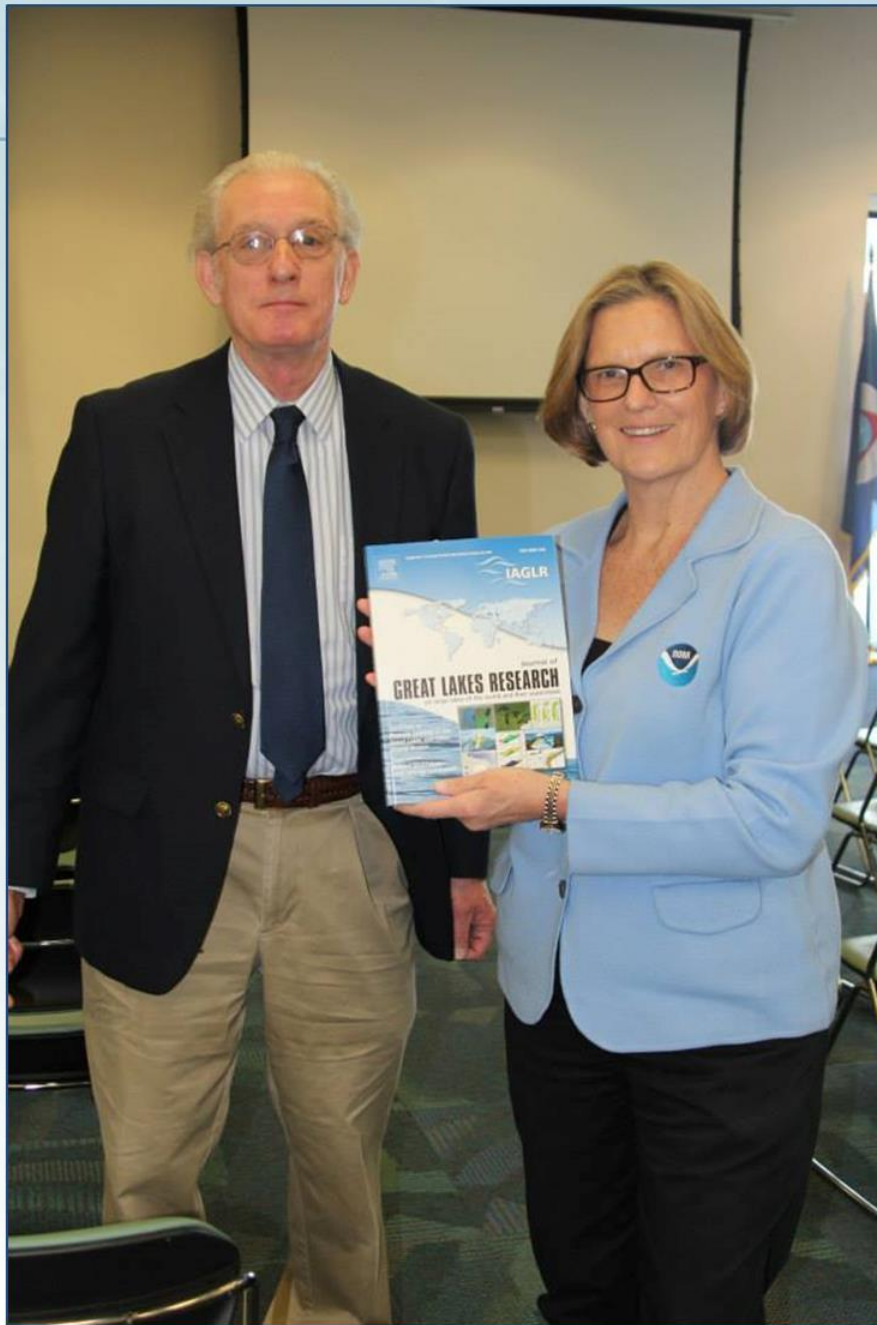
Available online 15 August 2013

Introduction

Observational data collection of the Laurentian Great Lakes has advanced during the past decade to such a level as to allow real-time analysis from moorings and near real-time from satellite data. Ocean color satellite-based remote sensing provides a rich data set that when properly analyzed allows for the generation of geospatial maps of chlorophyll, dissolved organic carbon, suspended minerals, harmful algae blooms (HABs), surface plumes, benthic vegetation communities, pri-

coastal zone color scanner (CZCS), satellite optical measurements of pigments and sediment became accessible. Despite the relatively coarse CZCS spatial resolution, investigators working in the coastal ocean and Great Lakes demonstrated that satellite sensors presented an enabling technology to the natural sciences and resources communities. Additionally, Leshkevich (1985) described lake ice estimates and classification during winter, demonstrating satellite data was useful for supporting regional remote sensing research year-round.

Currently, regional remote sensing applications are derived from a suite of airborne and satellite sensors that includes radar sensors aboard RADARSAT 1/2 and Envisat, and optical sensors on Landsat, SeaWiFS, MODIS, MERIS, VIIRS and HICO. Recent airborne prototype hyperspectral imager (HSI) data from NASA Glenn Research Center have also successfully shown the ability to quantify an annual harmful algal bloom (HAB) occurring in the West Basin area of Lake



Former Acting NOAA Administrator (and former astronaut) Dr. Kathy Sullivan with George Leshkevich and *JGLR* Special Issue on Remote Sensing at GLERL, 19 February 2014

Join our team!



April 24, 1999

Questions?



Credit:

NASA Visible Earth, provided by the SeaWiFS Project, NASA/Goddard Space Flight Center,
and ORBIMAGE

<http://eoimages.gsfc.nasa.gov/images/imagerecords/52000/52939/S1999114182039.png>

Questions



Workshop for Remote Sensing of Coastal and Inland Waters



Mouw and Greb,
Eos, Transactions American
Geophysical Union
[Volume 93, Issue 39](#), page
375, 25 September 2012



Madison, Wisconsin, 20–22 June 2012

Coastal and inland water bodies, which have great value for recreation, food supply, commerce, transportation, and human health, have been experiencing external pressure from direct human activities and climate change. Given their societal and economic value, understanding issues of water quality, water quantity, and the impact of environmental change on the ecological and biogeochemical functioning of these water bodies is of interest to a broad range of communities. Remote sensing offers one of the most spatially and temporally comprehensive tools for observing these waters. While there has been some success with remotely observing these water bodies, many challenges still remain, including algorithm performance, atmospheric correction, the relationships between optical properties and biogeochemical parameters, sufficient spatial and spectral resolution, and a lack of uncertainty estimates over the wide range of environmental conditions encountered across these coastal and inland water bodies.