



Cyanobacteria Assessment Network (CyAN)

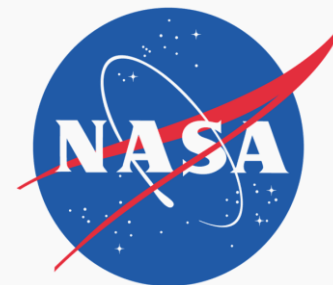
Ocean Color Research Team Meeting: May, 2014

Blake Schaeffer – EPA

Keith Loftin - USGS

Richard Stumpf – NOAA

Jeremy Werdell – NASA





Introduction

- HABs = \$2.2 billion annual freshwater degradation (Dodds et al. 2009).

The Columbus Dispatch **The New York Times**

Toxic algae in Hoover Reservoir cost city

Choking on growth, part III

The Washington Post

Polluted farm runoff linked to toxic green algae

- Cyanobacteria and their toxins are addressed differently by each state (Graham et al. 2009)
- Timely and useful delivery of satellite data is needed (Schaeffer et al. 2013).

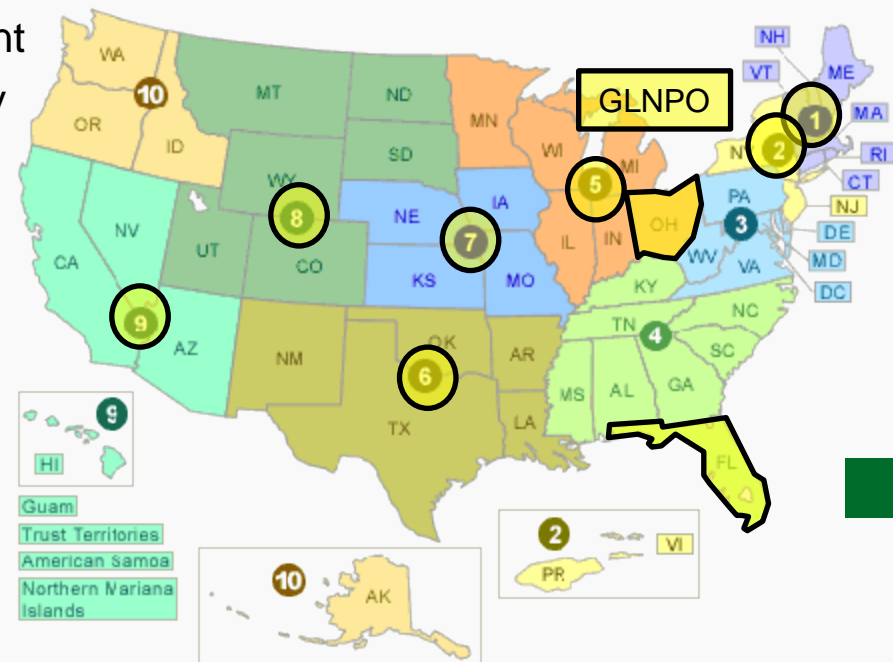
Introduction

- Mainstreaming satellite ocean color capabilities into U.S. water quality management decisions.
 - health and welfare of human society
 - consequences of land use change for human societies
 - ecosystem change
- NASA expertise assures stakeholders
 - Optimize federal partnerships to achieve common goal

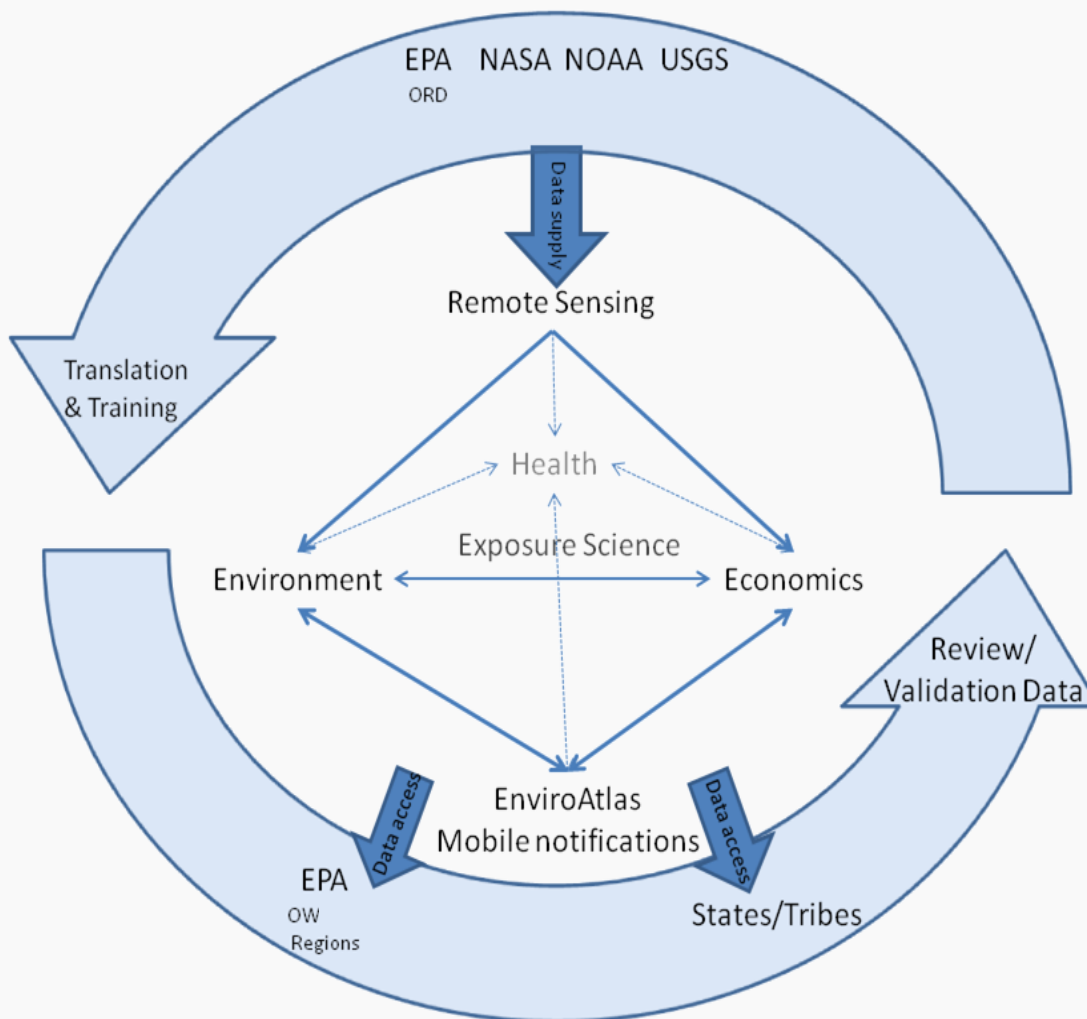


Partners and Stakeholders

- Previous support
 - EPA - NASA Applied Science Program announcement NNH08ZDA001N
 - NOAA - NASA Applied Science Program announcement NNH08ZDA001N
 - EPA - Office of Research and Development, Pathfinder Innovation Project II
- EPA Office of Water
 - Office of Wetlands, Oceans, and Watersheds
 - Office of Wastewater Management
 - Office of Science and Technology
- States
 - Ohio EPA
 - St. Johns River WMD
 - S. Florida WMD



Technical Approach





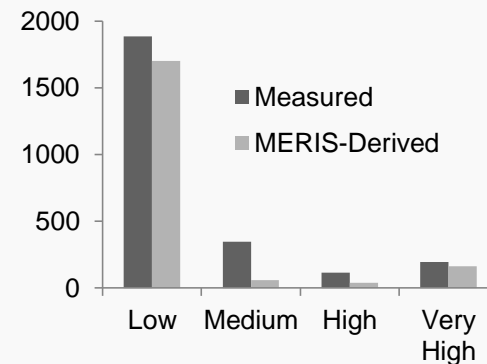
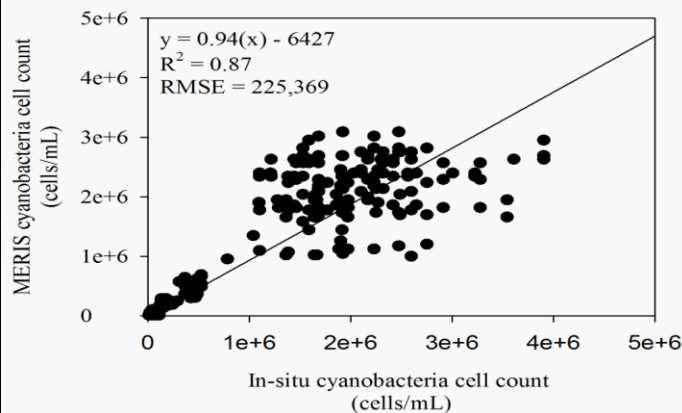
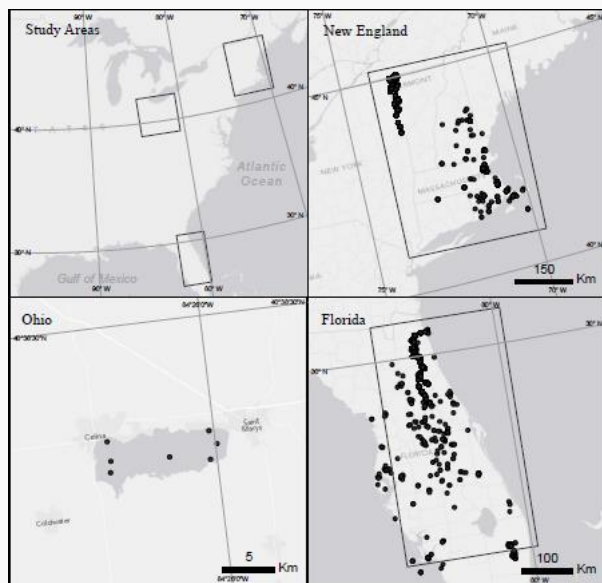
Technical Approach

- **Remote Sensing**
 - *Uniform and systematic approach for identifying cyanobacteria blooms.*
 - *Strategy for evaluation and refinement of algorithms across platforms.*
- **Environment**
 - *Identify landscape linkages causes of chlorophyll-a and cyanobacteria.*
- **Health**
 - *Exposure and human health effects in drinking and recreational waters.*
- **Economics**
 - *Behavioral responses and economic value of the early warning system.*
- **Notifications**
 - *Bring the technology to EPA, states and tribal partners.*

Technical Approach

- Remote Sensing
 - *Uniform and systematic approach for identifying cyanobacteria blooms.*
 - Second derivative spectral shape algorithms (SS; Wynne et al. 2008)

$$SS(\lambda) = \rho_s(\lambda) - \rho_s(\lambda_-) + \{\rho_s(\lambda_-) - \rho_s(\lambda_+)\} * \frac{(\lambda - \lambda_-)}{(\lambda_+ - \lambda_-)}$$





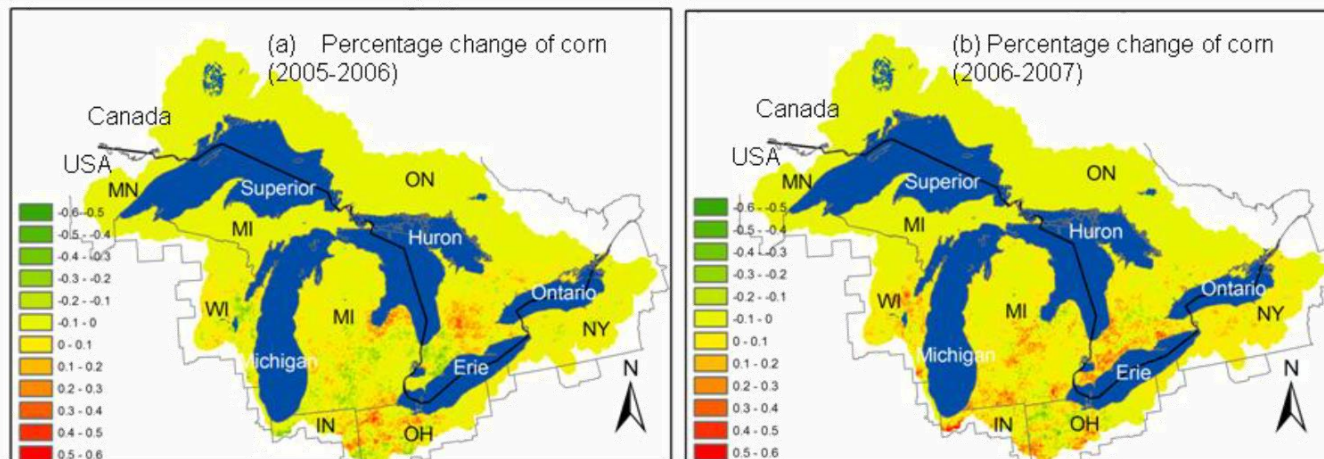
Technical Approach

- **Remote Sensing**
 - *Strategy for evaluation and refinement of algorithms across platforms.*
 - Model output from *in situ* radiometry vs. *in situ* metrics for cyanobacteria.
 - Satellite radiometry vs. *in situ* radiometry and model output from satellite radiometry vs. *in situ* metrics for cyanobacteria (Bailey and Werdell 2006; Werdell et al. 2009)
 - Model outputs from multiple satellite instruments such as MERIS and Landsat (Franz et al. 2005).

Technical Approach

- **Environment**

- *Identify landscape linkages causes of chlorophyll-a and cyanobacteria.*
- Evaluate chlorophyll-a concentrations and cyanobacteria cell count trends.
- Identify changes related to land-cover modifications (2001–2016).
- 13+ years of data observations across Great Lakes Basin, including all inland lakes (≥ 100 ha), focus on sources of potable water.





Technical Approach

- **Health**
 - *Exposure and human health effects in drinking and recreational waters.*
 - Remote sensing provides opportunity to estimate human exposure to cyanotoxins over specific geographic areas
 - Health care partner surveillance for potential cyanobacteria exposure and health effects will collect biological samples.
 - Veterinary practices and wildlife health agencies collect biological samples and records from exposed animals.
 - Retrospective evaluation of existing health records among communities with a past history of cyanobacteria blooms detected via satellite.



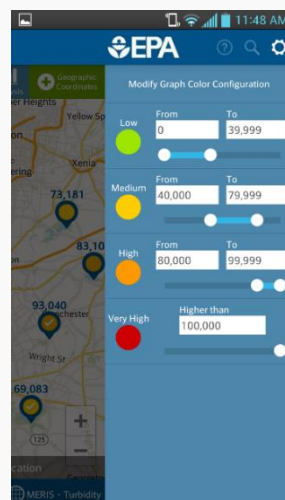
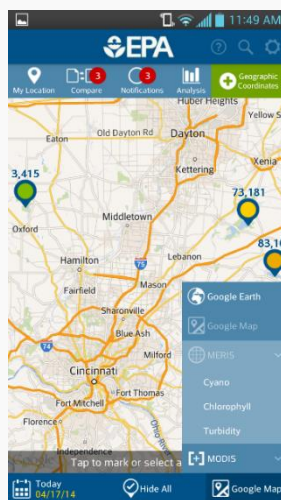
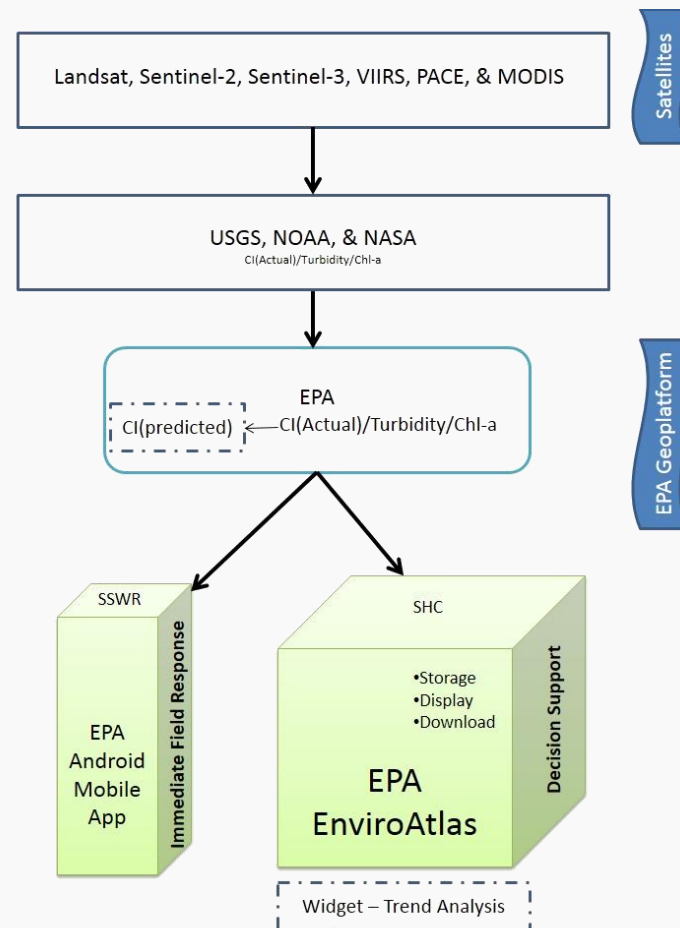
Technical Approach

- **Economics**
 - *Behavioral responses and economic value of the early warning system.*
 - Database of public resources spent on monitoring or responding to HABs. Assessment of the potential value of more comprehensive monitoring by satellite.
 - Economic impact of avoiding toxic and nuisance bloom events in freshwater lakes.

Technical Approach

• Notifications

- *Bring the technology to EPA, states and tribal partners.*
- Ocean color satellite data not processed and delivered to stakeholders in a manner that demonstrates its practical value to daily life (Schaeffer et al. 2013).
- Data pushed from NOAA, NASA and USGS to EPA Mobile Android Platform on weekly time-steps.



Satellite Health Bulletin, Florida Dept. of Health and NOAA, continuing with MODIS

Experimental Cyanobacteria Health Bulletin: Mar 26, 2012

To report an illness related to a marine toxin or algal bloom please contact the Florida Poison Information Center-Miami Aquatic Toxins Hotline at 1-888-232-8635.
 For questions about the report: contact Becky Lazensky, FL-DOH, at 352-955-1900. Images/data were obtained from Florida Water Management Districts, The National Oceanic and Atmospheric Administration (NOAA), NOAA National Climatic Data Centers and National Weather Centers. Support to produce this report was received through a NOAA/NASA Agreement (Number: NNH08ZDA001N)

CI Multi Image March 26, 2012

Cyanobacteria HABs Conditions Report: March 26

- Lakes Apopka and Dora (Orange and Lake Counties) both displayed high estimated cyanobacteria concentrations.
- Newnans, Lochloosa, and Orange Lakes (Alachua and Marion Counties) displayed high estimated cyanobacteria concentrations.
- Lake Jesup (Seminole County) displayed high estimated cyanobacteria concentrations.

Apopka

Dora

Newnans
Lochloosa
Orange

Jesup

Does Your Agency Have Validation Data to Share with NOAA?

The satellite images we feature in this bulletin are currently in the experimental phase until a full scientific validation process is completed. As part of this process, we are always seeking water quality, phytoplankton, and algal toxin data for freshwater sites in Florida over 1 km in size. This information can be used to compare what is shown in the satellite imagery with actual field data and improve the accuracy of the final product.

If you have data that you feel may be useful for the satellite validation process, you can contact Becky Lazensky at: (352) 955-1900.

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Impacts

- Inform water quality standards, advisories and guidelines under the Clean Water Act and Safe Drinking Water Act.
- Complement National Aquatic Resource Surveys
- Applied novel sophisticated tool to assist in management of events that may involve significant risk to the public.
- Increased use of remotely sensed water quality data to improve decision support in EPA and state agencies
- Decrease costs of monitoring, improve resource allocations, and reduce exposures

