NASA Science Mission Directorate
Earth Science Division
Applied Sciences Program

Cyanobacteria Assessment Network (CyAN)

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NASA Water Resources PI Meeting July 18-19, 2017
Cyanobacteria Assessment Network (CyAN)

Mission:

Support the environmental management and public use of U.S. lakes and estuaries by providing a capability of detecting and quantifying algal blooms and related water quality using satellite data records.

Objectives:

A. Create a standard and uniform approach for early identification of algal blooms that is useful and accessible to stakeholders of freshwater systems using the new set of satellites: Ocean Land Colour Instrument (OLCI) on Sentinel-3, Sentinel-2, Landsat and future NASA missions;

B. Develop an information dissemination system for expedient public health advisory postings;

C. Better understand the connections between health, economic and environmental conditions to cyanobacteria and phytoplankton blooms.
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Stakeholders

+ Swim Guide
+ Lake Pontchartrain Basin Foundation
+ Environment Canada
+ Additional state DEQs
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Partner communities future engagement

- Community-Focused Exposure Risk Screening Tool
- Estuary Data Mapper
- Drinking Water Tools
- Report on the Environment

+ additional state DEQs (FL, OH, CA and Utah)
+ PISCES Foundation (NGO funding source, WQ monitoring technology)
+ Swim Guide (interoperable data standards, mobile app integration for recreational beach warnings)
+ NGO Lake Pontchartrain Basin Foundation (use and validate CyAN data)
+ Environment Canada (avoid reinventing wheel)
Key datasets, models, scientific, technical tools –

Archived MERIS CONUS data delivery; 2017+ Sentinel-3
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Approach

Transitioning CONUS satellite derived water quality from research to operational

- Validation plug 'n play statistics
- CONUS validation
- Cyanobacteria
- Temperature
- Turbidity
- Chlorophyll-a
- New algorithms
- Mobile application
- RS Tools
- EnviroAtlas
- SeaDAS
- C-FERST
- ROE
- DW Tools
- Estuary Data Mapper
- Applications (Extent, Frequency, Duration & Magnitude)
- Training, workshops, and engagement
- Decision making:
  - Office of Water
  - Regional Offices
  - State DEQs
  - NGOs
  - USACE
  - Utilities
- New missions
- Outside workshop & tool development
- NASA GSFC WQ
- Supports HABHRCA, CWA, SDWA
- NGOs + state DEQs
Impacts—CyAN in the news

Through the Cyanobacteria Assessment Network (CyAN), EPA Region 8 requested support for the State of Utah for early access to satellite imagery based on the severity of cyanobacteria blooms from the previous year.

Utah Department of Environmental Quality (DEQ) conducted its routine monthly sampling on June 12, 2017.

Satellite imagery the following week indicated a bloom was developing in Provo Bay, so DWQ scientists returned to the area on June 22, 2017, for follow-up sampling.

On June 29th, DEQ issued an advisory about a cyanobacteria bloom detected in Utah Lake, warning the public and pets to stay out of the lake's Provo Bay.

Local news articles related to the Utah DEQ press release acknowledge the bloom was first detected via satellite imagery (e.g., See Warnings posted for visitors due to algal bloom in Provo Bay, Public warned to avoid Provo Bay in Utah Lake due to algal bloom, Toxic algae’s return to Utah Lake could force it to close for holiday weekend, Algal bloom returns to Utah Lake in Provo area).
Transition Strategy

- Imagery processing
  - Sentinel-3 @ NASA GSFC and NOAA
  - Sentinel-2 and Landsat @ GEE and/or EROS
- Frequency, Extent, Duration and Magnitude
  - Office of Water and Regions
  - Report on Environment
  - C-FERST
  - DW Tools
  - SwimGuide
Lessons Learned

With a 3 x 3-pixel array, MERIS/Sentinel-3 (300-m) resolves 0.7% of freshwater bodies in the U.S. & ~33% public surface water intakes.

With a 3 x 3-pixel array, Landsat/Sentinel-2 (30m) resolves 62% & 95% of freshwater bodies and public surface water intakes.

Shifting focus for chlorophyll-a toward Sentinel-2 at the moment.

Currently focusing on secchi/turbidity for Landsat-8.
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Highlights

• Statistical methods for algorithm comparison complete
• IOCS Workshop on algorithm comparison
• Extensive surface water temperature validation complete
• Extent and Frequency metrics transition toward annual CONUS delivery per state
• Mobile application functioning on EPA production network servers and moving toward stakeholder beta testing
• Training webinars on RS Tools and SeaDAS software
• Delivery of CONUS MERIS CI product to all stakeholders
• Arthur S. Flemming Award 2016
• Clark et al 2017; Stumpf et al 2016; and Stumpf et al 2016 analysis supported NASA PACE justifications
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Cyanobacteria Frequency

Percent of observation dates with high concentration cyanobacteria (>100,000 cells/ml). Years 2008-2011

- PRELIMINARY DATA -
Publications


Seegers et al. (FY17 In Prep). Strategic and robust approaches to performance assessment of satellite ocean color algorithms. Journal of Marine Systems.


Urquhart et al. (Accepted). A method for examining temporal changes in cyanobacteria harmful algal bloom spatial extent using satellite remote sensing. Harmful Algae.