CYANOBACTERIA ASSESSMENT NETWORK

CyAN Science Team
2016
Target Data Criteria for **Database Schema**

- Natural and manmade lakes and ponds
- GoM Coastal data
- Temporal/spatial datasets within waterbody
  - Low, medium, and high concentrations for phytoplankton, pigments, toxins, WQ variables
- Sample metadata, methods, QA/QC plans

**Tiered Criteria for Field Data Fitness of Purpose**

**Quality Control Tiers**

- Documentation - Study Design, Sample Collection/Processing, Analytical Methods
- Converging Lines of Evidence - Agreement between field values at a threshold basis

**Interpretative Thresholds for Data Comparison, Algorithm Development and Validation**

- WHO and EPA Thresholds for Microcystins
- Using microcystins, chlorophyll, and cyanobacterial abundance
- Trophic Status Thresholds (e.g. Chlorophyll, Secchi Depth, Nutrients)
Work Package 2

- 3 band reflectance model derived from USGS Landsat 7 & 8 surface reflectance products to predict chlorophyll (chl \(a\)) concentrations in lakes and ponds.

- Model validated using predicted chl \(a\) concentrations and data from state water quality monitoring programs in North Carolina (Jordan Lake) and Rhode Island (Newport water supply).

\[
(1/R_{rsB2} - 1/R_{rsB4}) \times R_{rsB3}
\]

\[
\text{Chl \(a\) meas (\(\mu g/L\))}
\]

\[
\text{Chl \(a\) pred (\(\mu g/L\))}
\]

\[
\begin{align*}
\text{n} & = 25 \\
R^2 & = 0.85 \\
\text{MAE} & = -0.001 \\
\text{MAPE} & = 15.4\%
\end{align*}
\]

\[
\begin{align*}
\text{Chl \(a\) meas (\(\mu g/L\))}
\end{align*}
\]

\[
\begin{align*}
\text{Chl \(a\) pred (\(\mu g/L\))}
\end{align*}
\]

\[
\begin{align*}
\text{n} & = 47 \\
R^2 & = 0.81 \\
\text{RMS} & = 37.7 \mu g/L; \text{RMSE} = 7.9 \mu g/L \\
\text{MAE} & = 6.0 \mu g/L; \text{MAPE} = 10.8\% \\
\text{Bias} & = 0.03
\end{align*}
\]
Work Package 2

Assessment of Landsat Surface Temperature Product

Lake Temperatures (2005-10)
- 0-5 deg
- 5-10 deg
- 10-15 deg
- 15-20 deg
- 25-30 deg
- 30-35 deg

In situ and Landsat Surface Temperatures across 15 Landsat 5/7 Scenes: 2005-2010

R² = 0.9719
Bias (Average) = +11.8% (not significant at α=0.05)
RMSE = 1.353°C (celsius)
MAE = 1.362°C (celsius)
MAPE = 8.64%

y = 0.9526x - 0.2053
Work Package 2 & 3

- Preliminary versions of NOAA cyanobacteria algorithms implemented into NASA standard processing software
  - Joint evaluation with NOAA ongoing
  - First vetted implementation expected in Spring 2016
  - To be made publicly available via SeaDAS (seadas.gsfc.nasa.gov)

- MERIS regional extracts identified & produced
  - CA, OH, FL, New England, plus Great Lakes (not shown to left)
  - Example products available to stakeholders in Spring 2016
  - Full mission time-series available in Summer 2016
  - Reprocessing(s) anticipated following algorithm refinements
Work Package 4

Work Package 4 & 5

- Statistical time series analysis of blooms in FL, OH, and CA (2008-2011)
- Heat maps and surface drinking water intake monitoring methods
“Beach-goer behavior during a retrospectively detected algal bloom at a Great Lakes beach”
• An early product
• 2016 Recreational Waters Conference, April 12–15, 2016, New Orleans, Louisiana

Study of beachgoer characteristics and behavior at a great Lakes beach during summer, 2003
• Beach attendees not notified of algal bloom
• Algal bloom retrospectively identified at beach using MERIS data from the Envisat-1 satellite
• Beach attendees did not avoid the water during the bloom

Community level evaluation of health effects associated with algal blooms
• Partners- states of Ohio and California Departments of Public Health
• Analyze hospital admission and emergency room visits of potentially impacted communities before, during and after algal blooms
• Progress: human subjects and other approvals for data
Work Package 6

• GEOValue Data to Decisions: Valuing the societal benefits of geospatial information workshop

• Gathering data on costs of HAB monitoring programs:
  – Ohio EPA
  – Washington Dept. of Ecology
  – EPA Region 5
  – EPA Region 9

• National Center for Environmental Economics
Work Package 7: Decision Support

- Mobile Application Infrastructure
  - Administrative website
  - Data management module
  - Processing module
- EPA National Computing Center deployment
  - FedRAMP compliant, FISMA approved.
  - Proxied access, fire walls abound.
  - Future Cloud deployment possible
- Mobile app debugging:
  - IDE breakpoints, view code execution/results, see immediate effects of code changes.
- geoTIFF product configuration for GIS analysis
  - ArcGISToolbox for data extraction from geoTIFFs, beta testing by California
Work Package 7: Decision Support