CyanoLakes – public information services for cyanobacteria blooms

International Ocean Colour Sciences Meeting
Lisbon Portugal
15 May 2017
What is CyanoLakes?

CyanoLakes aims to be a globally recognizable brand providing commercial services which assist in the management of aquatic ecosystems by providing real-time information and forecasts on cyanobacteria blooms and water pollution using earth observation satellite remote sensing technology.
Our Vision

"To be a leading commercial provider of operational services and value-added products to the public and private sector for cyanobacteria blooms and water pollution based on satellite earth observation, with global coverage and market reach, significantly increasing the use of earth observation derived information for water health, safety and management"
Why cyanobacteria?

Cyanobacteria occur in most of the world’s freshwaters due to increasing pollution and rising temperatures. They pose a health threat to recreational water users from various chronic and acute health effects. Cyanobacteria produce lethal toxins that have been linked to cancer and neurodegenerative diseases.
Value proposition

• prevent, detect and manage health risks
• improve the health and safety of users
• enhance routine monitoring and reporting
• reduce long-term monitoring costs
• improve management strategies
• improve decision making
• compliment potable water treatment systems
• achieve compliance with legislation
Diagnose problem

Measure from satellite

Apply relevant guidelines

Inform decision makers and general public

Recommend safety for use
Distinguishing cyanobacteria from algae

1. Internal structure
   1. Prokaryotic chromatoplasm
   2. Intracellular gas vacuoles
      1. Enhanced backscattering
      2. Vertical buoyancy

2. Pigmentation
   1. Phycobilipigments are dominant

3. Fluorescence
   1. Chlorophyll-a contained in PSI
   2. High re-absorption due to buoyancy

Simultaneously handles 3 cases:

1. **Fluorescence domain (681 peak) – low/med biomass**
   a) Eukaryote (SICF)
   b) Special case: prokaryotes (no SICF)

2. **Scattering domain (709 peak) – high biomass**
   a) Eukaryotes
   b) Prokaryotes

3. **Floating domain (753 peak)**
   a) Cyano scum
   b) Floating aquatic vegetation
   c) Special case: adjacency effect

- Chl-a range of 0.5 – 300 mg m⁻³, expected error of 30 - 70% and a sensitivity approx. 3.5 mg m⁻³
- Rayleigh corrected TOA reflectance
MPH products

Lake Victoria, Kenya

MPH products

MPH sensitivity – cyano detection

Original calibration curve fits “pure” cyano population

PCI index is sensitive to and varies with the % of cyanobacteria to total phytoplankton biomass

“Improve the monitoring of the health risk from cyanobacteria and eutrophication in a large number of South Africa's water bodies through disseminating timely and accurate information, and to integrate the information into the national monitoring database”
For an interactive detailed map viewer, click on the dam name in the table below.

<table>
<thead>
<tr>
<th>Dam</th>
<th>Health risk *</th>
<th>Cyanobacteria cell count (cells/ml)</th>
<th>Nutrient pollution **</th>
<th>Last updated</th>
<th>Partial Contact</th>
<th>Full Contact</th>
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<tbody>
<tr>
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<td>317000</td>
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<tr>
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<td>2 days ago</td>
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</tr>
</tbody>
</table>

* Based on the concentration and presence of toxin producing cyanobacteria

** Based on the trophic status thresholds: very high = hypertrophic, high = eutrophic, medium = mesotrophic and low = oligotrophic
“Monitoring on a national scale is very expensive, logistically challenging and labour intensive. The Department of Water and Sanitation is in support of this “eye-in-the-sky” approach to monitoring Eutrophication which will allow monitoring of more water bodies (dams and lakes) which were not considered in the current network. The remote-sensing information will allow us to optimise our monitoring network and streamline our activities. The data generated will lead to a significantly improved ability to manage and mitigate the harmful effects of potentially toxic cyanobacteria blooms and nutrient enrichment (eutrophication), which are widespread in SA dams.”

Ditselatsela Elijah Mogakabe
Directorate: Resource Quality Services
Acknowledgements and thanks


Kartoza development team: Gavin Fleming, Christian Christelis, Dimas Ciputra, Admire Nyakudya

Project team: Michael Silberbauer, Elijah Mojagabe, Jennifer Molwantwa, Wandile Nomquphu, Rob Hart, Annelie Swanepoel, Brendon Theunissen, Paul Botes, Solomon Mahladisha, Alfred Seloana, DWS laboratory staff, Stewart Bernard, Paul Oberholster, Jeremy Kravitz, Keneilwe Hlahane, Zimbini Faniso, Derek Griffith, Russell Main, Andy Rabagliatti, the CHPC, Hein Swart, Peter Bosscha

Friends & mentors: Daniel Odermatt, Lee Annamalai, Trevor Probyn, Marie Smith, Hayley Evers-King, Lisl Robertson, Frank Shillington

MPH recal data providers: Caren Binding, Steven Greb, Peter Hunter, Peter Keller, Oliver Koester, Sampsa Koponen, Tiit Kutser, Bunkei Matsushita, Stephanie Palmer, Petra Philipson, Matyas Presing, Antonio Ruiz Verdú, Rémy Tadonleke, Tom Block, Carsten Brockmann …

ESA, Marc Bouvet, Ewa Kwiatskowa

God my Father and the Lord Jesus Christ
Thanks

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