

# 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.



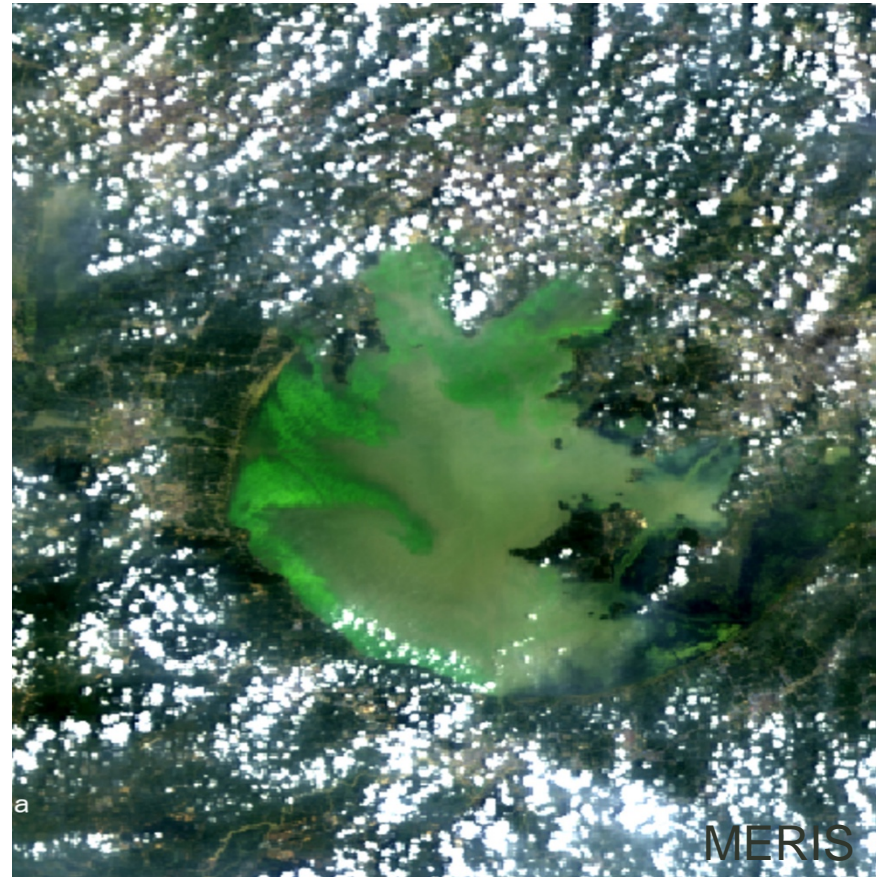
# Our Vision

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*"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?

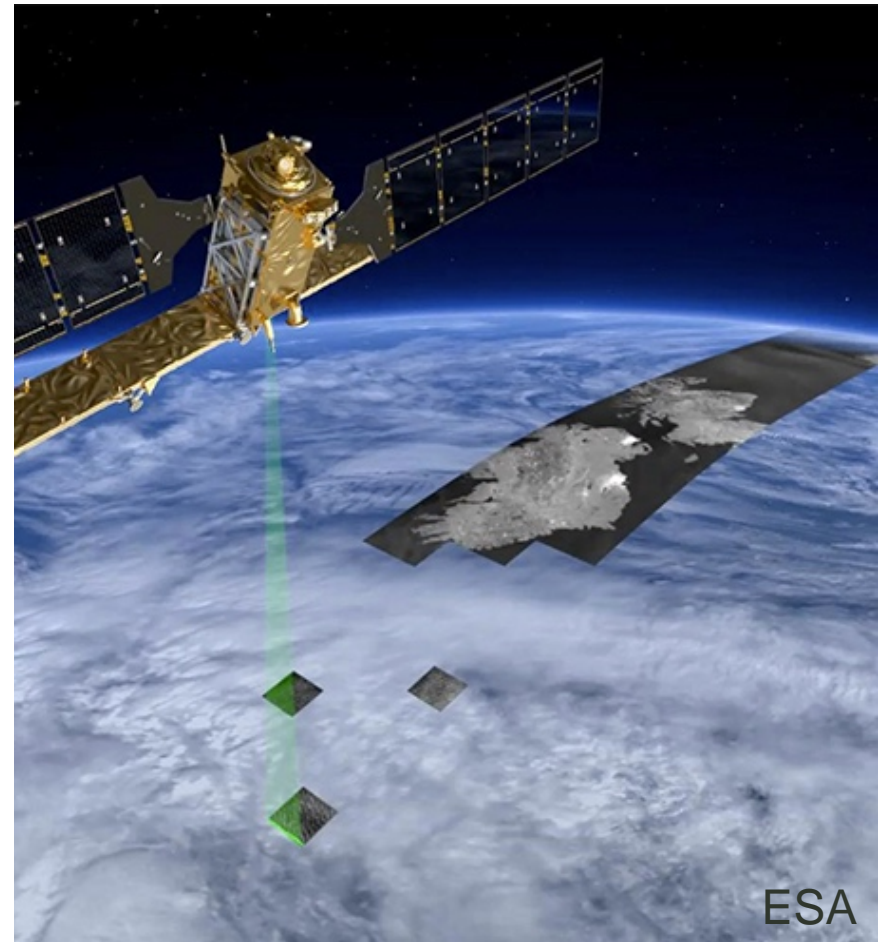
Cyanobacteria occur in most of the world's freshwaters due to increasing pollution and rising temperatures. They pose a health threat to recreational water users from various chronic and acute health effects. Cyanobacteria produce lethal toxins that have been linked to cancer and neurodegenerative diseases.





# 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





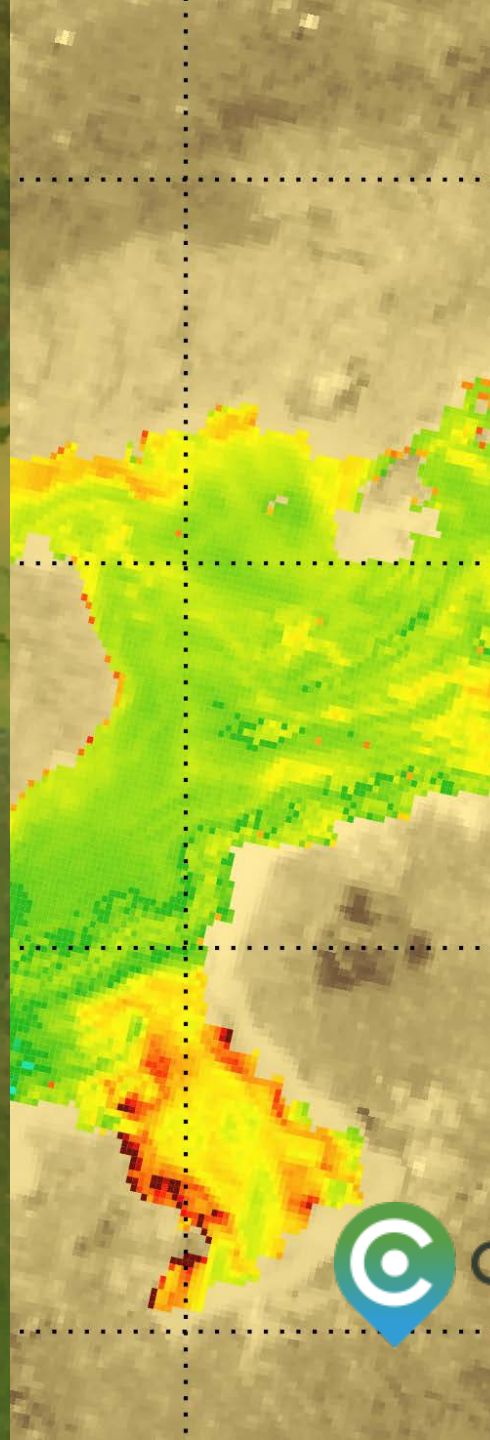
Diagnose  
problem

Measure from  
satellite

Apply relevant  
guidelines

Inform decision  
makers and  
general public

Recommend  
safety for use



**cyanolakes**  
MAKING YOUR WATER SAFER

# Distinguishing cyanobacteria from algae

## 1. Internal structure

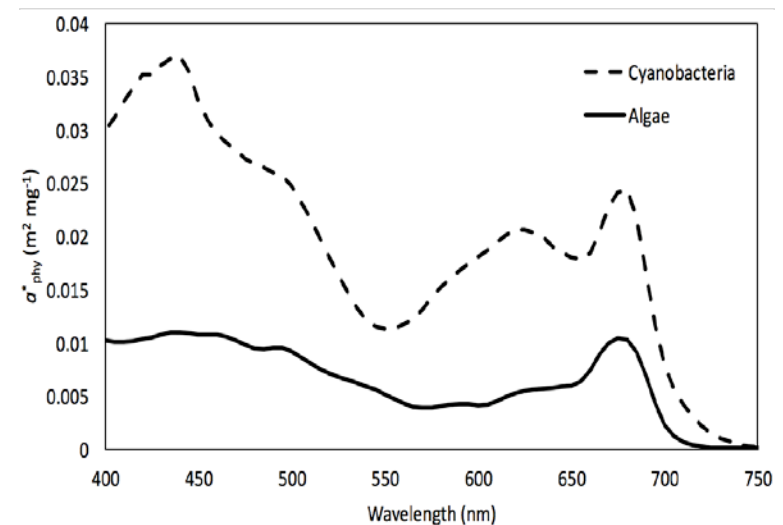
1. Prokaryotic chromatoplasm
2. Intracellular gas vacuoles
  1. Enhanced backscattering
  2. Vertical buoyancy

## 2. Pigmentation

1. Phycobilipigments are dominant

## 3. Fluorescence

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





# The MPH approach

Simultaneously handles 3 cases:

**1. Fluorescence domain (681 peak) – low/med biomass**

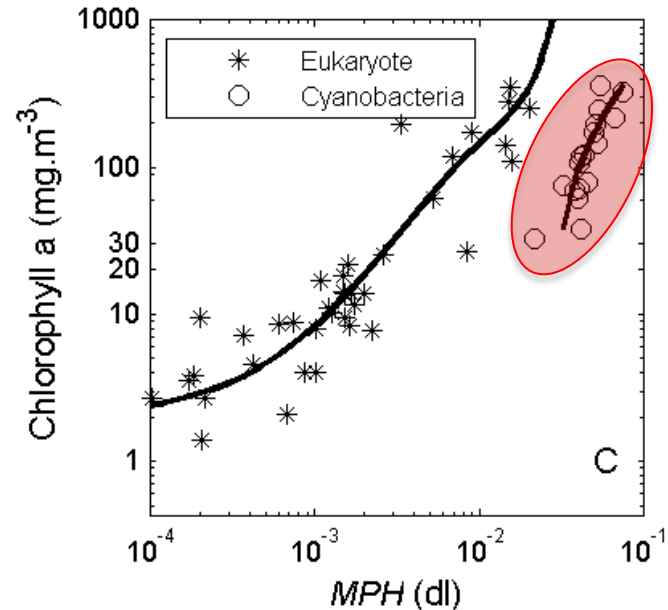
- a) Eukaryote (SICF)
- b) *Special case: prokaryotes (no SICF)*

**2. Scattering domain (709 peak) – high biomass**

- a) Eukaryotes
- b) Prokaryotes

**3. Floating domain (753 peak)**

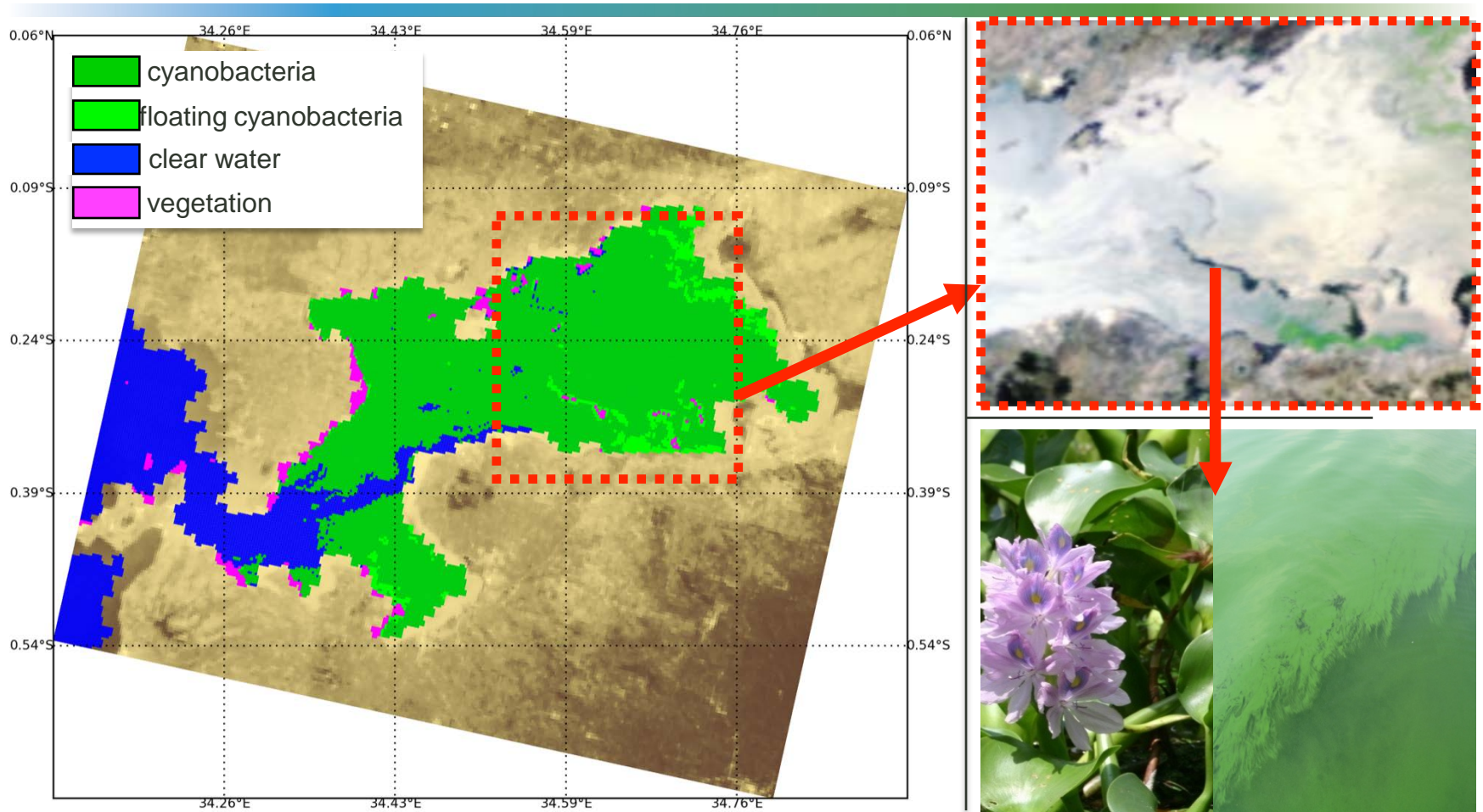
- a) Cyano scum
- b) Floating aquatic vegetation
- c) *Special case: adjacency effect*



- Chl-a range of 0.5 – 300 mg m<sup>-3</sup>, expected error of 30 - 70% and a sensitivity approx. 3.5 mg m<sup>-3</sup>
- Rayleigh corrected TOA reflectance

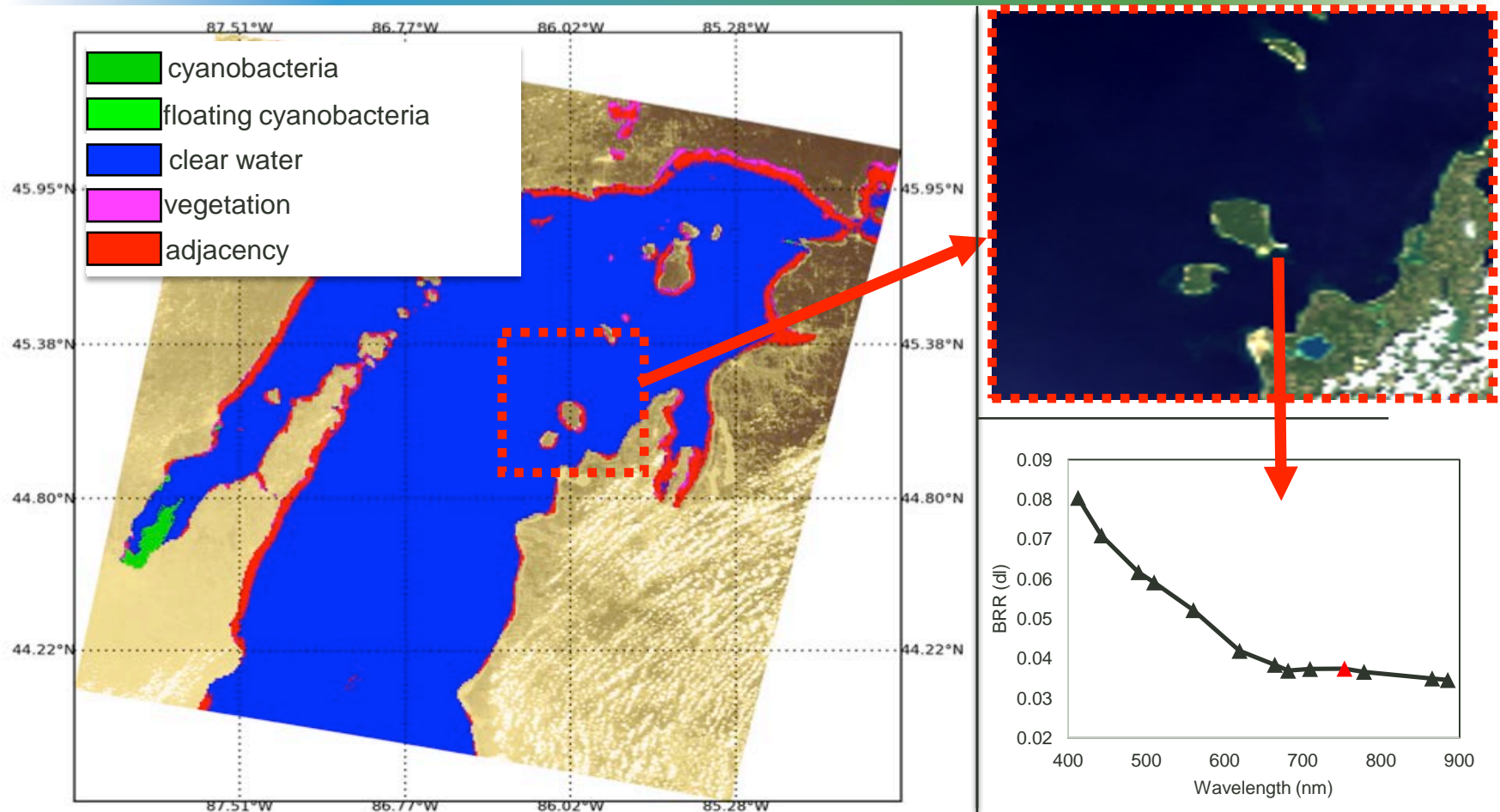


# MPH products



Lake Victoria, Kenya

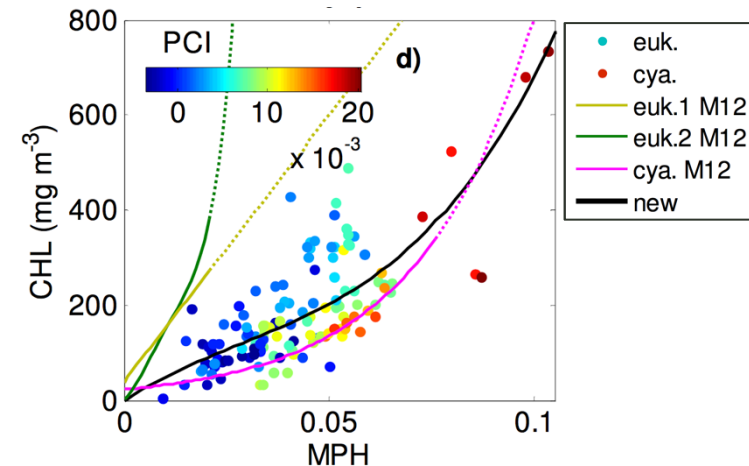
# MPH products



Lake Michigan, USA

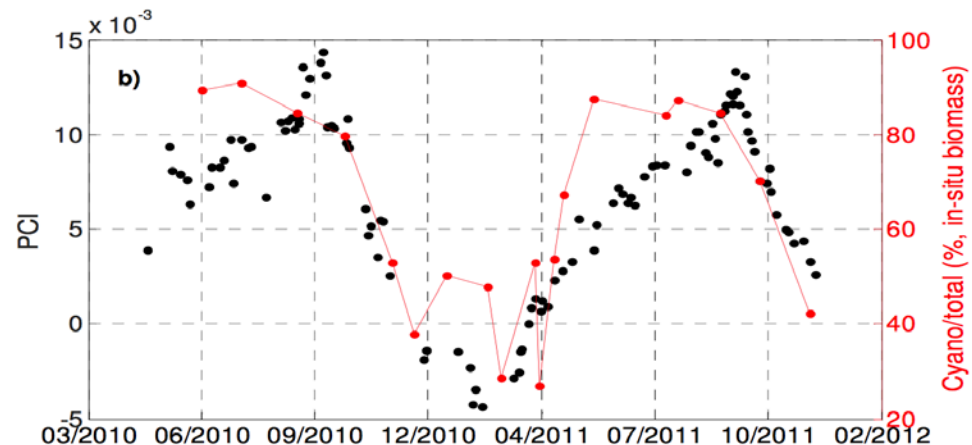
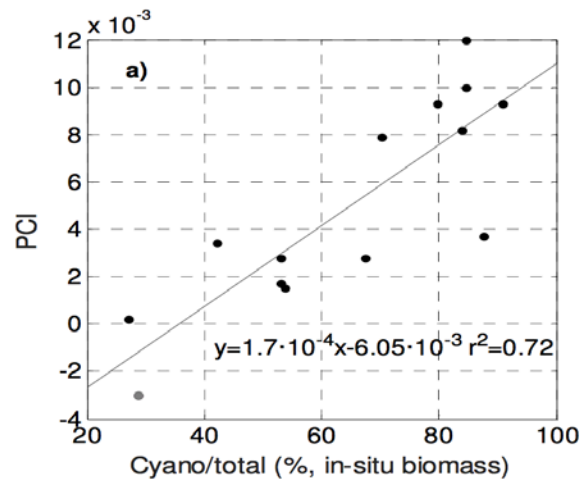


# MPH sensitivity – cyano detection



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”*



South African  
WATER RESEARCH COMMISSION  
Supporting sustainable development through research  
funding, knowledge creation and dissemination

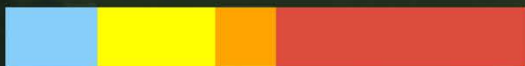


water & sanitation  
Department:  
Water and Sanitation  
REPUBLIC OF SOUTH AFRICA





Health Risk ?



Nutrient pollution ?



**102**  
DAMS TOTAL



Partial Contact Water Sport

**41**

40%



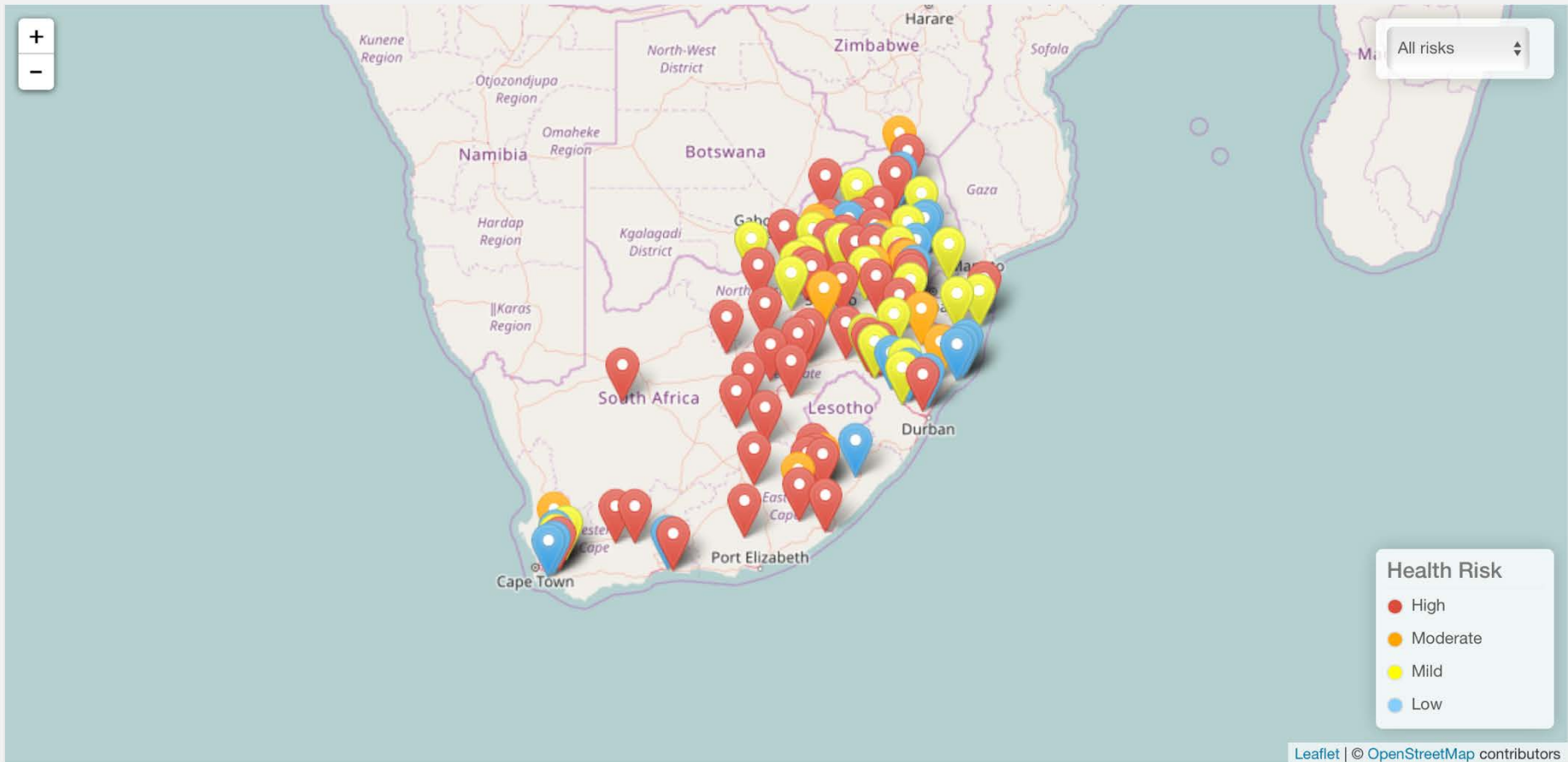
Full Contact Water Sport

**35**

34%

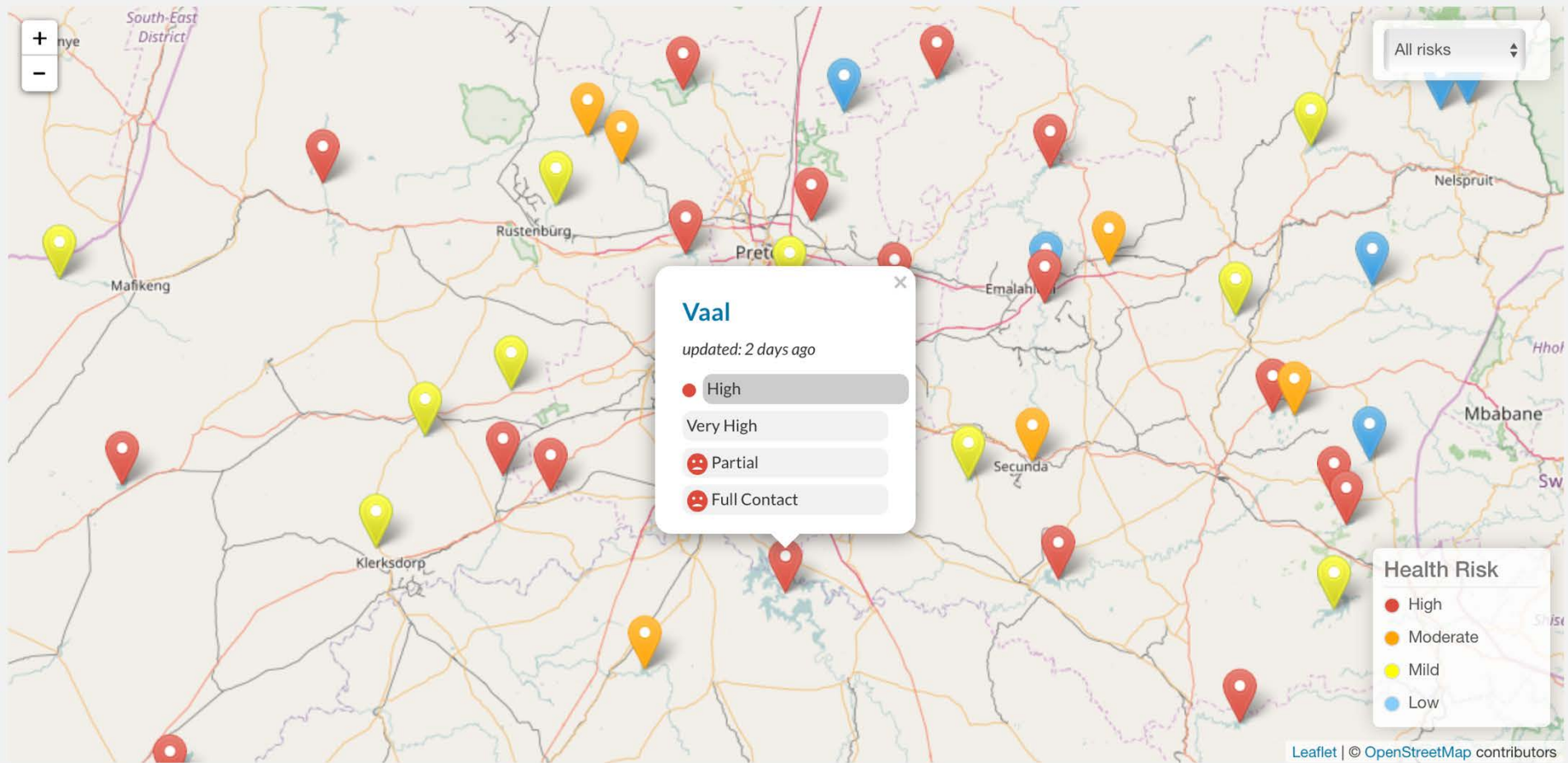
ON

last update 2017-05-07



ON

last update 2017-05-07



Select a date

2002-11-27

latest



For an interactive detailed map viewer, click on the dam name in the table below

Show 10 entries

Search:

Dam	Health risk *	Cyanobacteria cell count (cells/ml)	Nutrient pollution **	Last updated	Partial Contact	Full Contact
Kuhlange	High	833200	Low	2 days ago	☹	☹
Marico-Bosveld	High	1974800	Low	2 days ago	☹	☹
Darlington	High	370100	High	7 days ago	☹	☹
Woodstock	High	686300	Low	2 days ago	☹	☹
Allemanskraal	High	317000	Very High	2 days ago	☹	☹
Hartbeespoort	High	1586800	Low	2 days ago	☹	☹
Xonxa	High	1184700	Very High	3 days ago	☹	☹
Vaal	High	458900	Very High	2 days ago	☹	☹
BridleDrift	High	378900	Very High	2 days ago	☹	☹
Boskop	High	523800	Medium	2 days ago	☹	☹

Showing 1 to 10 of 102 entries

Previous 1 2 3 4 5 ... 11 Next

\* 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



<http://eonemp.cyanolakes.com>



Vaal

## VAAL

2017-05-07

Download data

2002-11-27

2017-05-07

chlorophyll-a concentration [mg/m<sup>3</sup>]

1 5 10 20 30 50 100 300 500 1000

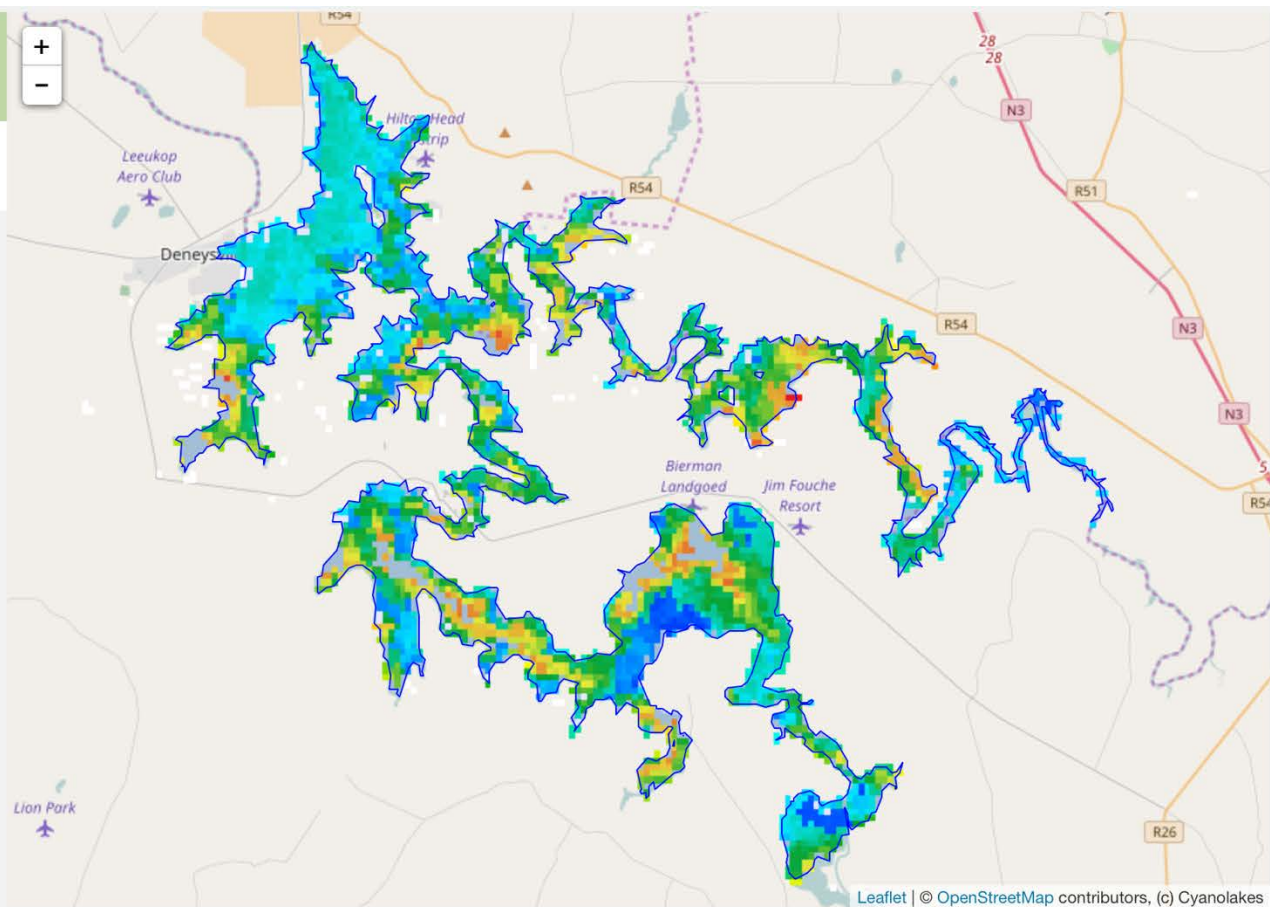
- ☒ Chlorophyll-a
- ☐ Cyanobacteria
- ☐ Cyanobacteria posing risk to health
- ☒ Cloud
- ☐ Vegetation

Cyanobacteria risk level

● High

Nutrient pollution

● High



Vaal

## VAAL

2017-05-07

Download data

2002-11-27

2017-05-07

chlorophyll-a concentration [mg/m<sup>3</sup>]

1 5 10 20 30 50 100 300 500 1000

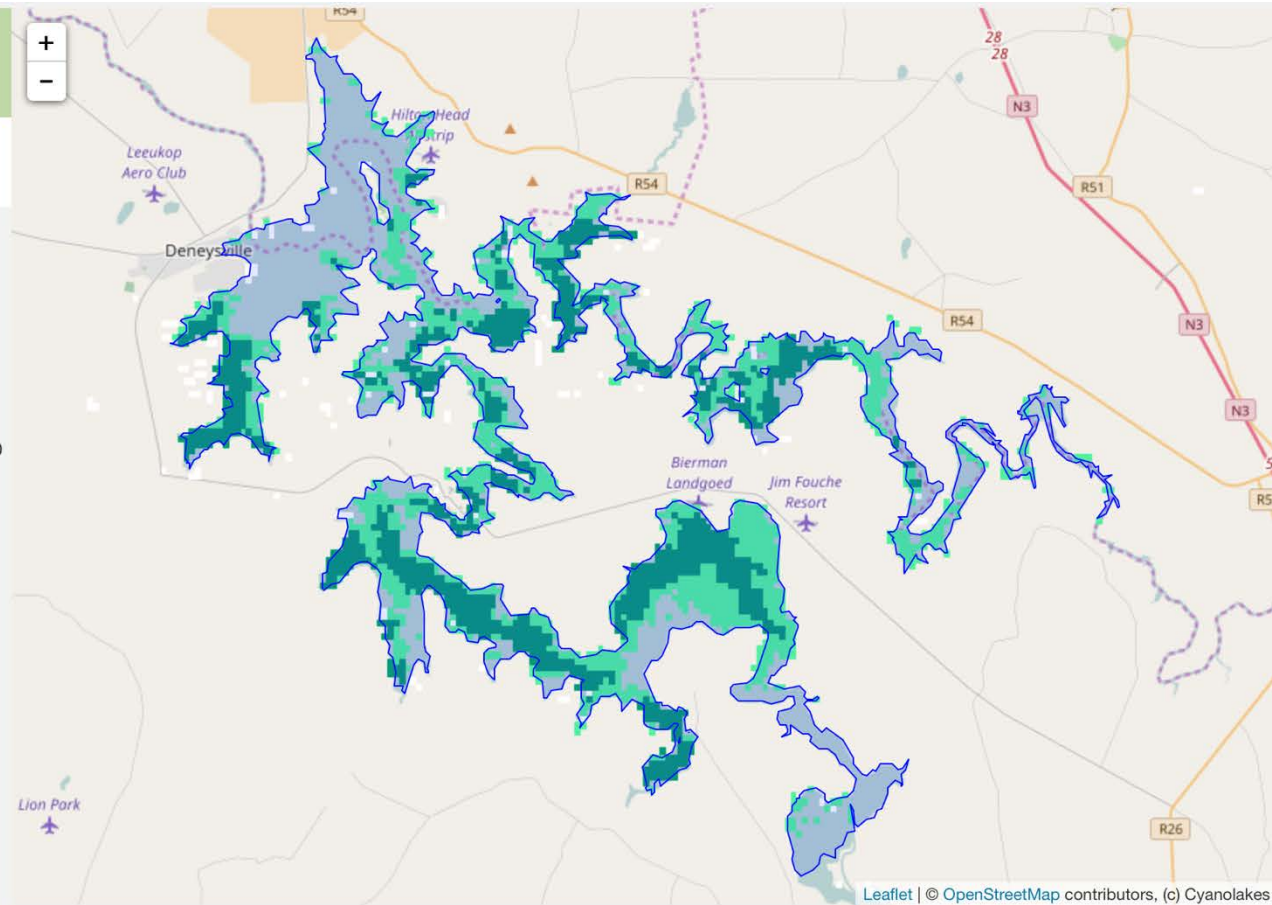
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Cyanobacteria risk level

● High

Nutrient pollution

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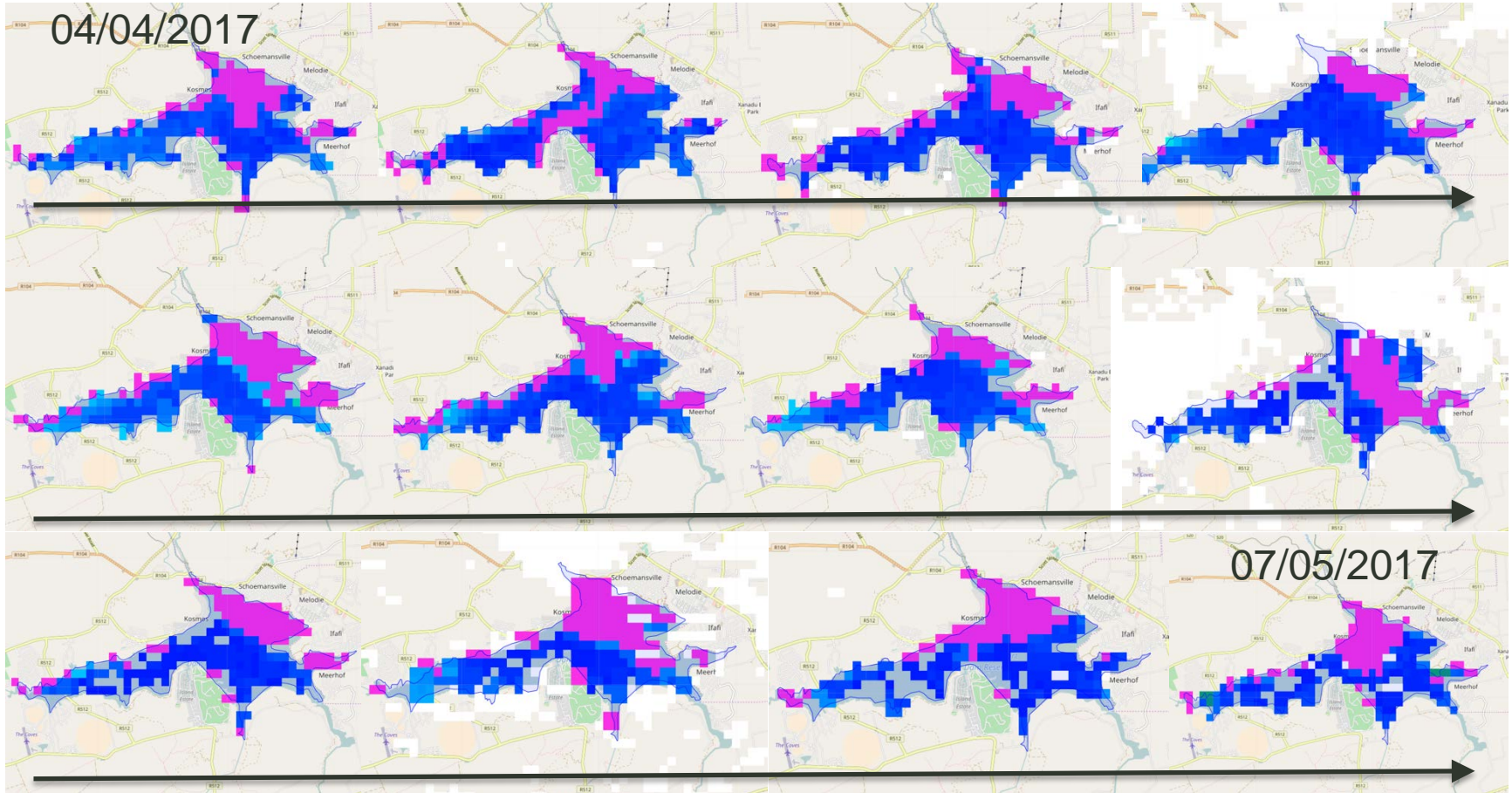








# EONEMP water hyacinth time series



*“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

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ESA, Marc Bouvet, Ewa Kwiatskova

God my Father and the Lord Jesus Christ



# Thanks

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