

NATIONAL OCIMs

High Resolution Remote Sensing for Plumes and Blooms

Dr Marié Smith¹, Lufuno Vhengani²

¹Coastal Systems and Earth Observation Research Group, CSIR Cape Town

²Geospatial Modelling and Analysis Research Group, CSIR Pretoria

ICM Lekgotla Durban, 27 February 2023



science & innovation

Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA



forestry, fisheries
& the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA



CSIR

Touching lives through innovation



National
Research
Foundation



SOUTH AFRICAN NATIONAL
SPACE AGENCY

The National OCIMS (Operation Phakisa - Initiative 6)

National Oceans and Coastal Information Management System



Coastal Viewer

Fisheries & Aquaculture Support

Marine Spatial Planning

Coastal Flood Hazard

Water Quality

Marine Predators

Coastal Operations at Sea

Integrated Vessel Tracking

Marine Information Management System (MIMS)

- A national system built on multiple **partnerships**
- **Dedicated** data center and IT infrastructure through the Marine Information Management System (MIMS)
- Promote FAIR data access, information sharing & adhere to international best practices
- Decision Support Tools developed through consultations between developers and stakeholders
- Long term vision and plans

Some focus areas



Noctiluca bloom
Table Bay 18 Sep 2019

The blooms



Surf-zone diatom blooms in
Muizenberg 29 Mar 2021



Colour front in False Bay
5 Nov 2018

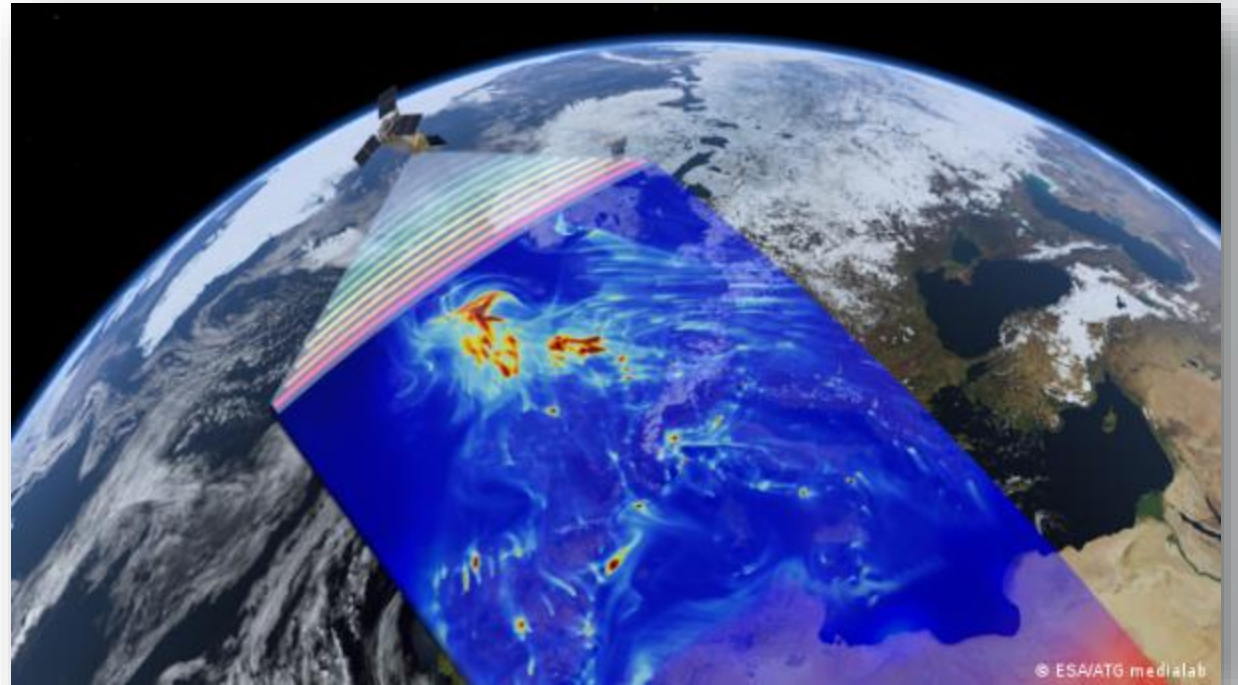
and the plumes



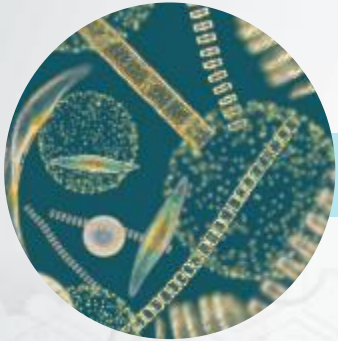
Greenpoint outfall
22 Jul 2017

Why use satellite data?

- Data are freely available
- It's a routine and reliable source of information
- It provides global coverage
- It provides historical coverage
- The combination of *in situ* and satellite information is often the most powerful



What can satellites measure?



Algal blooms



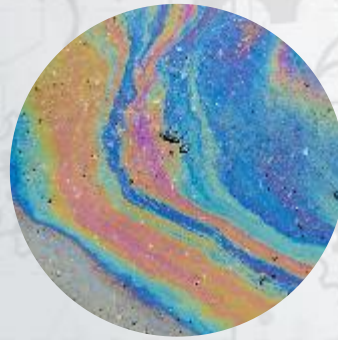
Floating vegetation



Water clarity



Suspended sediments



Surface oil slicks



Sea surface temperature

Ocean colour satellites

can't measure :

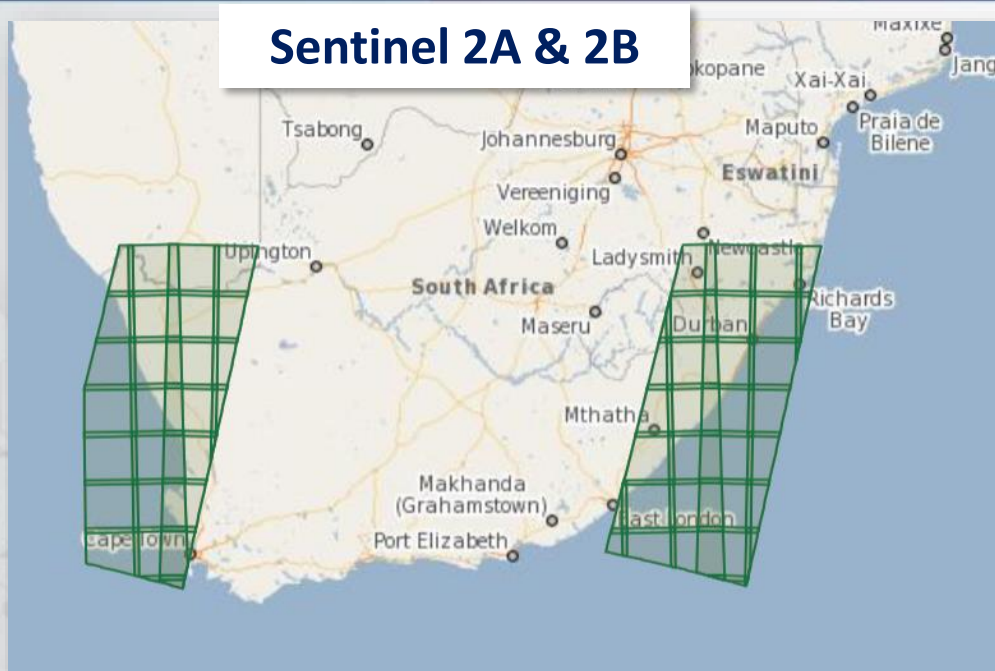
- x through clouds*
- x at night*
- x below the surface*
- x nutrients, DO, metals, pollutants, toxins*

Ocean colour remote sensing of the marine domain

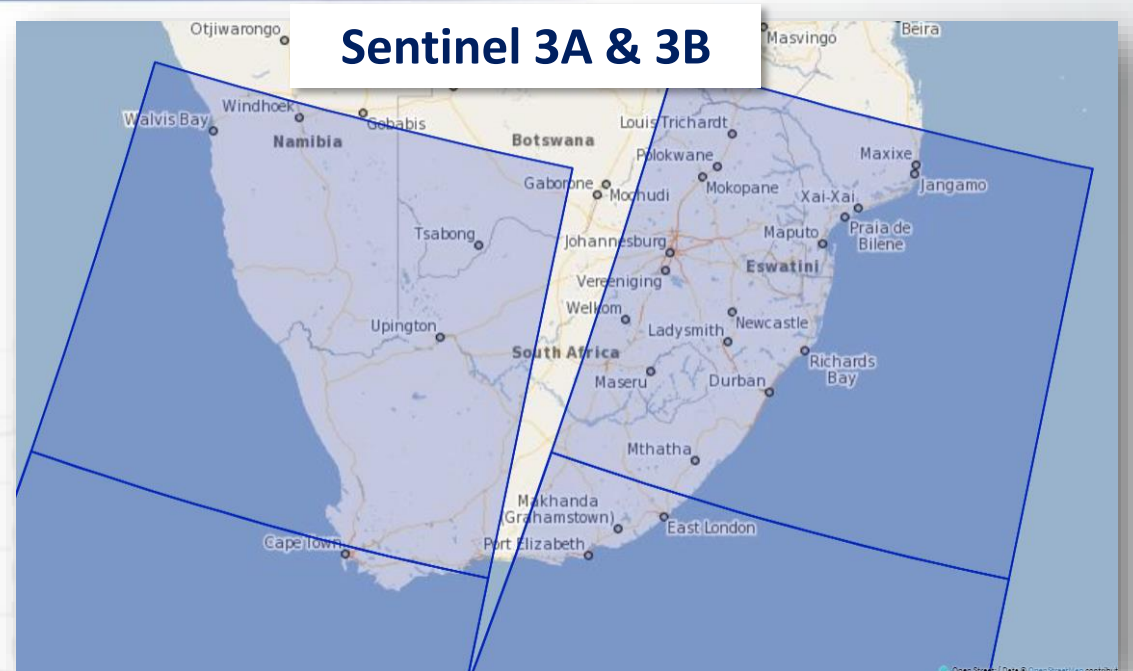
- Through OCIMS, we provide near daily ocean colour satellite data products for the entire EEZ of South Africa
- These products are generally provided 1km spatial resolution from the EU Copernicus mission satellites
 - Higher spatial resolution data are available...



Satellite coverage & resolution



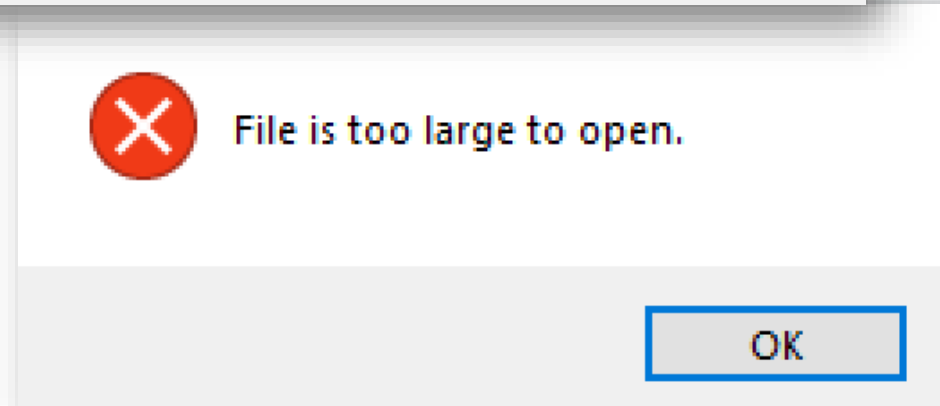
- Designed for land observation
- Narrow swath
- Higher spatial resolution (10-60m)
- 5-day revisit time



- Specifically designed for marine observation
- Wider swath
- Lower spatial resolution (300m – 1km)
- Daily revisit time

Why aren't high resolution ocean colour data used routinely (yet)?

- Computational demand of data files
 - One 110x110 km² granule ~650MB
- Lack of fit-for-purpose water quality products (using appropriate atmospheric correction)
- Cloud based resources exist (GEE, AWS), but are aimed at land-based products and applications
- Previously unvalidated for South African waters



EO4WQ: Research component

Being completed through the EO4WQ project:

- This is a **two year** (2022-2023) New Earth Observation Frontiers Domain Development Action funded by NRF/SANSA
- Focusing on the developing **high spatial resolution** (10-300m) water quality products
- from **freely available** environmental satellite data
- for the **coastal marine and estuarine** domains of South Africa



The Research component



Qualitative product



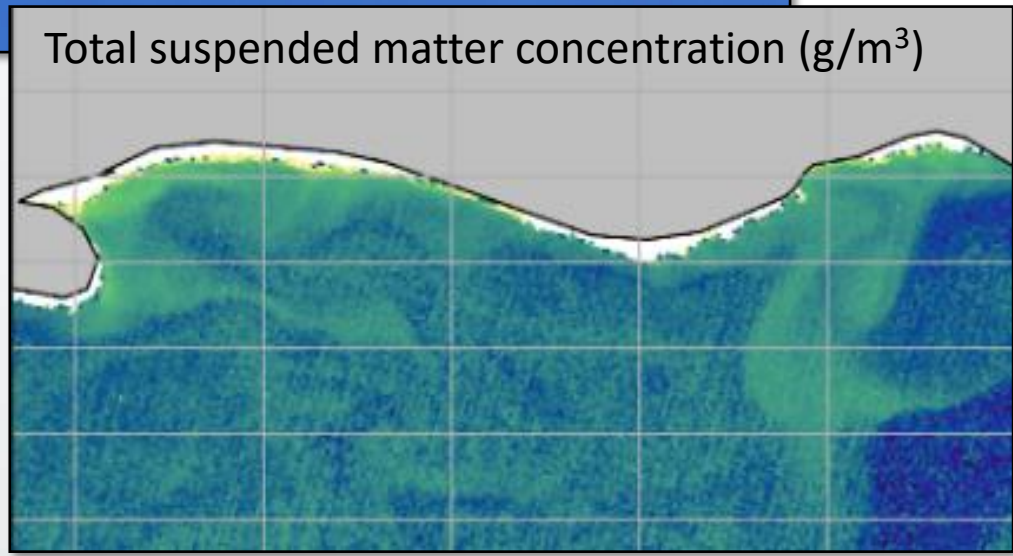
Marine atmospheric correction



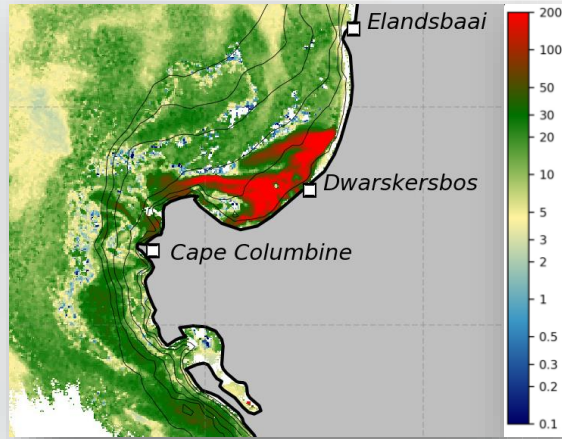
Test/validate product algorithms



Quantitative product



The Operational component



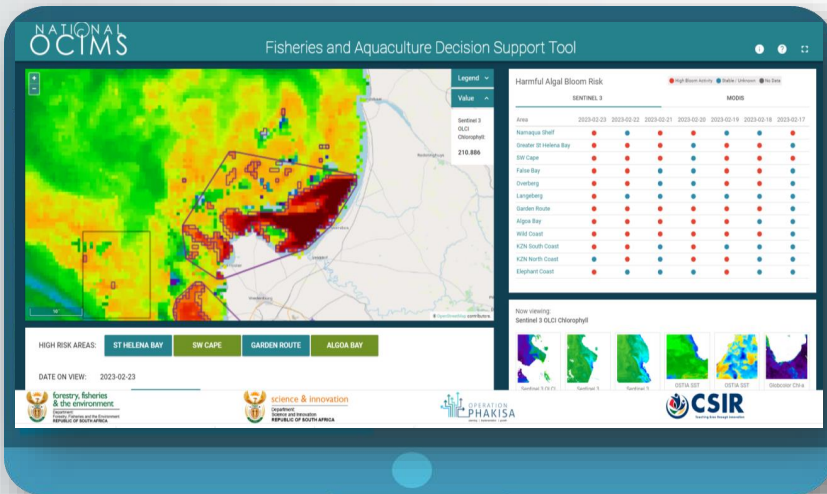
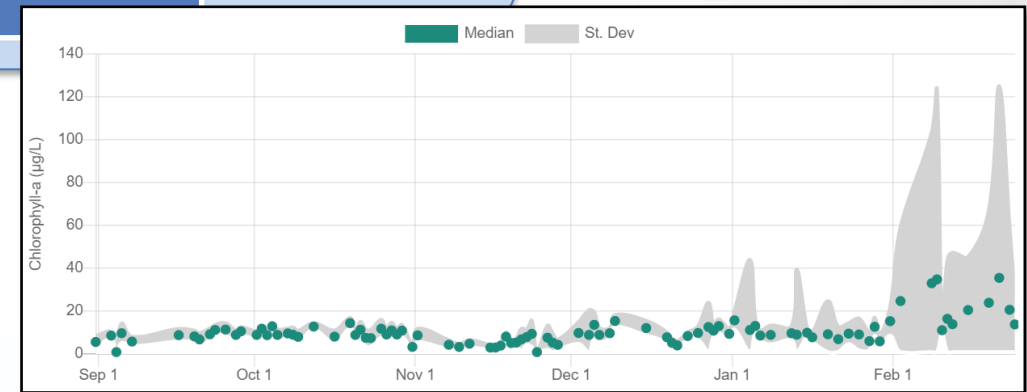
Validated satellite products

Appropriate resolution & timeliness

User consultation & feedback

Value-added indicators

Decision Support Tools



How it all fits together

Research



- **Goals:** Satellite validation, algorithm development

300m daily products

20m weekly products

Long-term datasets, Datacubes, APIs

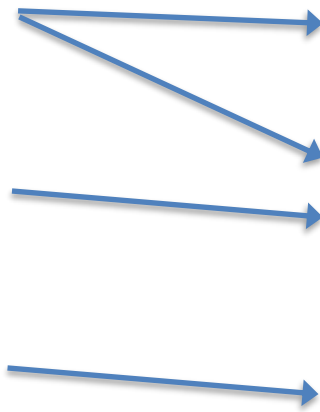
Operations

NATIONAL OCTIMS

Fisheries & Aquaculture Decision Support Tool

Water Quality Decision Support Tool

Marine Information Management System



EO marine service development and delivery to Africa



MarCOSIO



●●● MARINE AND COASTAL OPERATIONS
FOR SOUTHERN AFRICA AND THE INDIAN OCEAN

One of two Marine Thematic area consortia GMES & Africa programme. Represents the southern African and Indian Ocean partners.

Includes partners from Angola, Namibia, South Africa, Mozambique, Tanzania, Kenya, Madagascar, Seychelles, and Mauritius



Current Tools and upcoming solutions

OCIMS Fisheries and Aquaculture Decision Support Tool



<https://www.ocims.gov.za/hab/app/>

Current features:

- ✓ Map interface
- ✓ Date selector
- ✓ Sentinel3 1km SST [am&pm]
- ✓ Sentinel3 1km Chl-a [am]
- ✓ gap-free 5km SST, SST anomaly & Chl-a
- ✓ HAB features
- ✓ HAB alert panel

NATIONAL OCIMS Fisheries and Aquaculture Decision Support Tool

Harmful Algal Bloom Risk

Area	SENTINEL 3			MODIS			
	2023-02-21	2023-02-20	2023-02-19	2023-02-18	2023-02-17	2023-02-16	2023-02-15
Namaqua Shelf	●	●	●	●	●	●	●
Greater St Helena Bay	●	●	●	●	●	●	●
SW Cape	●	●	●	●	●	●	●
False Bay	●	●	●	●	●	●	●
Overberg	●	●	●	●	●	●	●
Langeberg	●	●	●	●	●	●	●
Garden Route	●	●	●	●	●	●	●
Algoa Bay	●	●	●	●	●	●	●
Wild Coast	●	●	●	●	●	●	●
KZN South Coast	●	●	●	●	●	●	●
KZN North Coast	●	●	●	●	●	●	●
Elephant Coast	●	●	●	●	●	●	●

Now viewing: Sentinel 3 OLCI Chlorophyll

forestry, fisheries & the environment
Department: Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

science & innovation
Department: Science and Innovation
REPUBLIC OF SOUTH AFRICA

OPERATION PHAKISA
planning | implementation | growth

CSIR
Teaching lives through innovation

Several improvements planned, watch this space!

(Temporary) OCIMS Water Quality Decision Support Tool



<https://online.cyanolakes.com/eo4wq>

Current features:

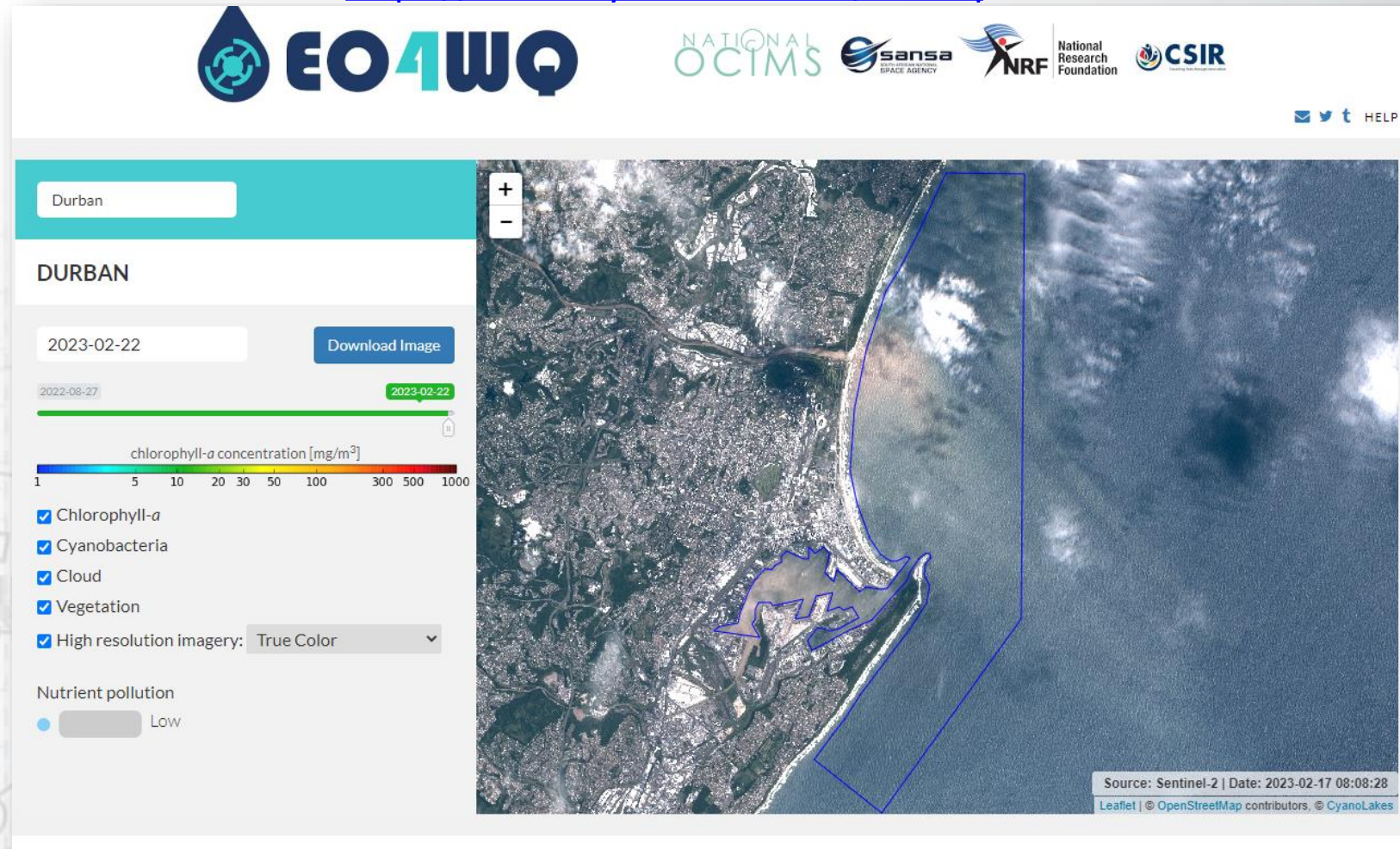
- ✓ 10 sites
- ✓ Map-based view
- ✓ Graphical view

Medium (300 m) resolution:

- ✓ Chl-a
- ✓ Cyanobacteria risk
- ✓ Floating vegetation

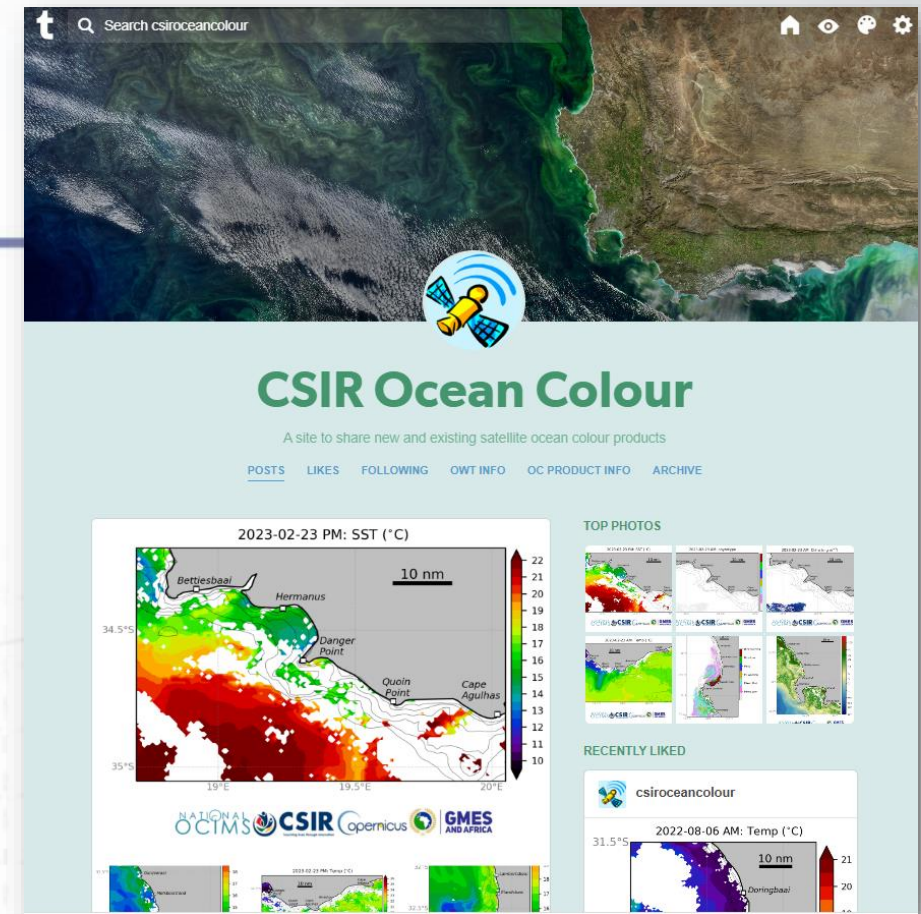
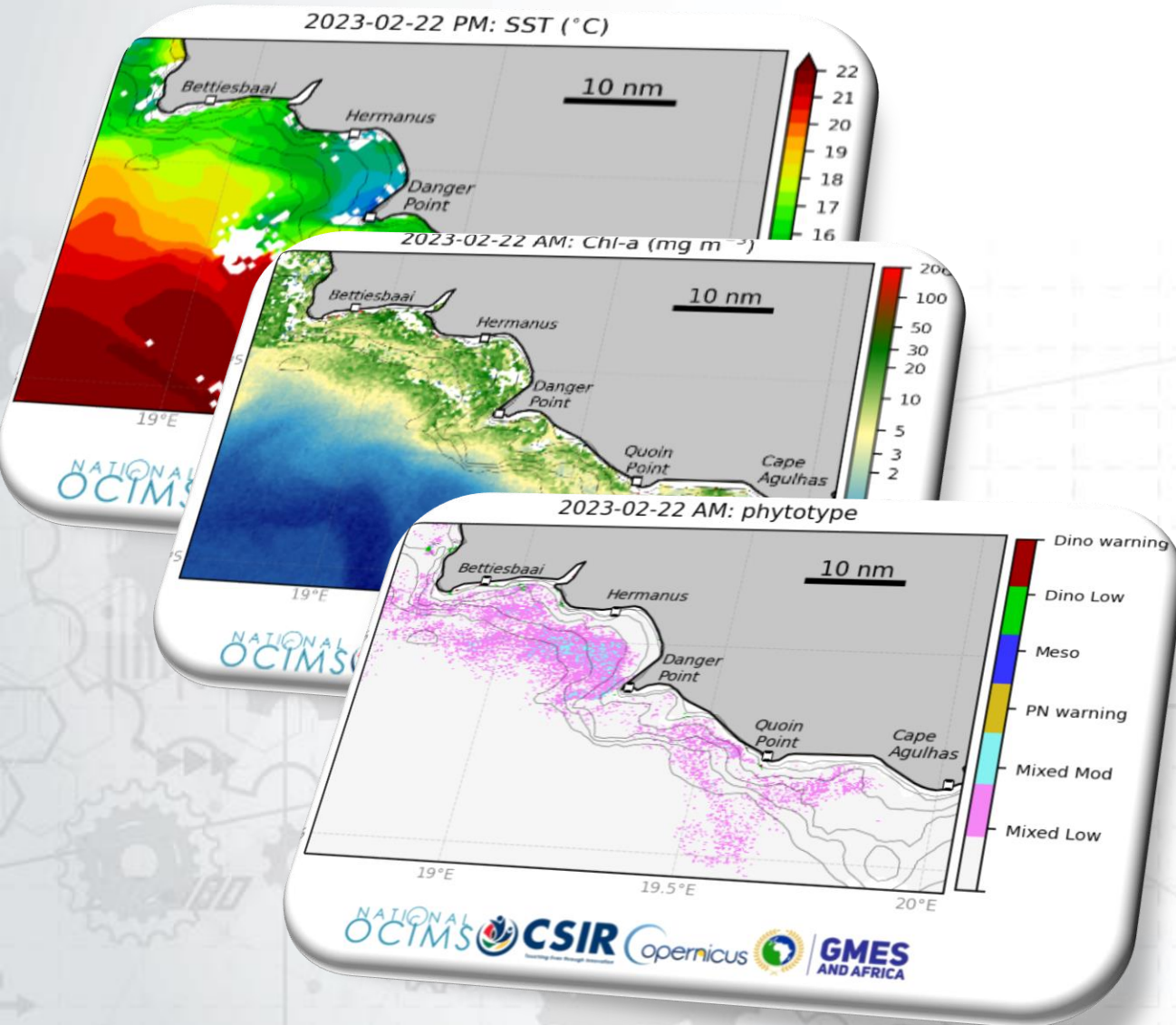
High (20 m) resolution:

- ✓ True colour (20m)
- ✓ Bloom risk
- ✓ Enhanced vegetation



New website and products coming, watch this space!

The CSIR Ocean Colour Tumblr



Regional maps in png format uploaded daily:

- Sea surface temperature (1km resolution, 2 times a day)
- Chlorophyll a concentration (300m)
- Phytoplankton Type (300m)

<https://csiroceancolour.tumblr.com/>

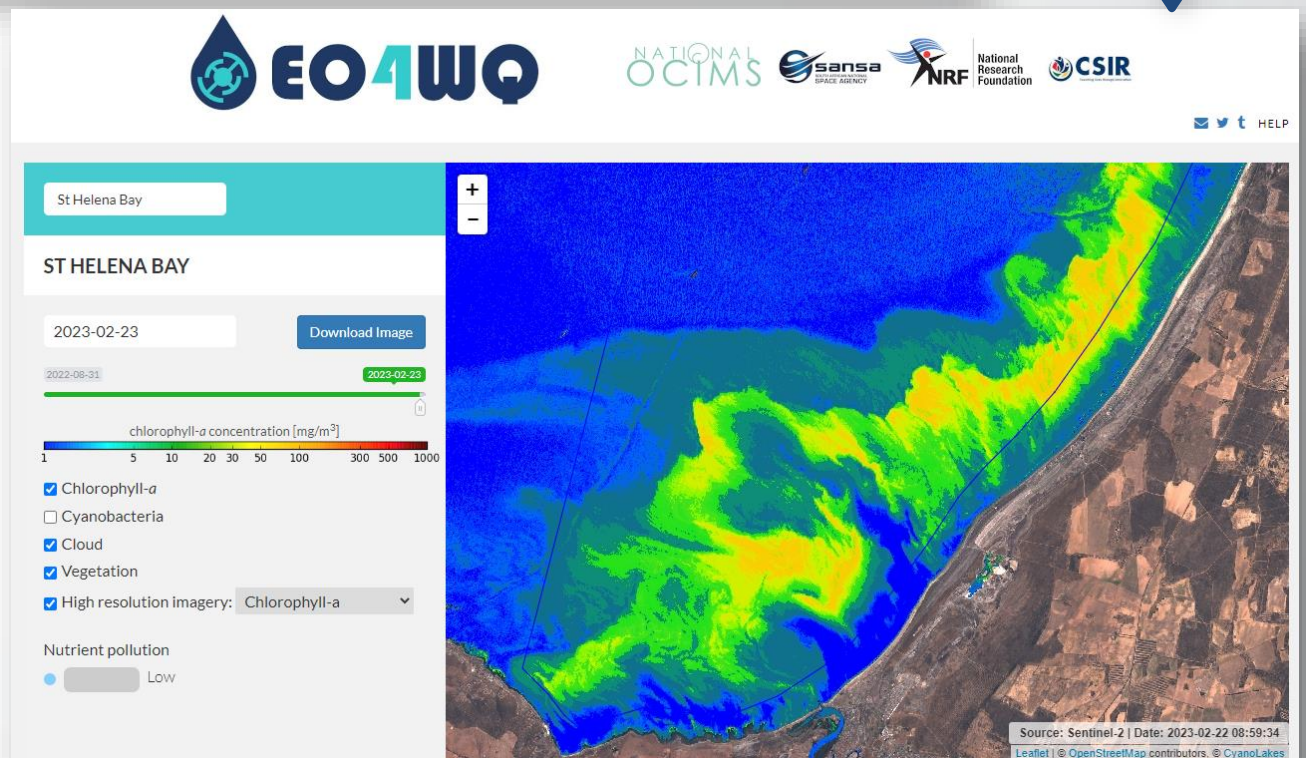
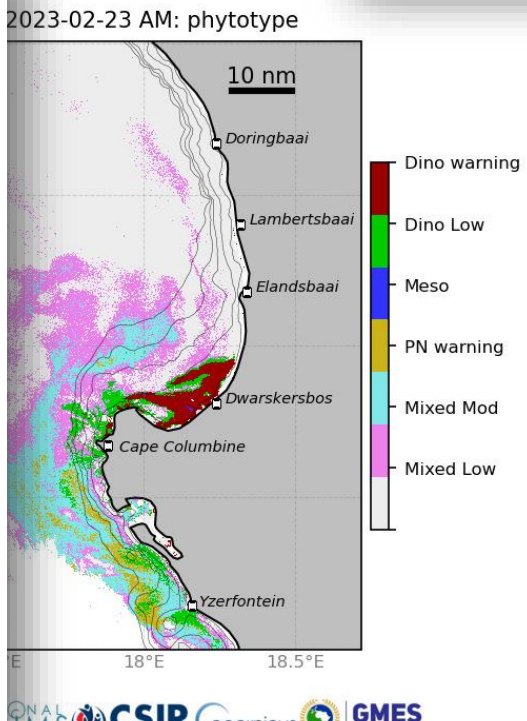
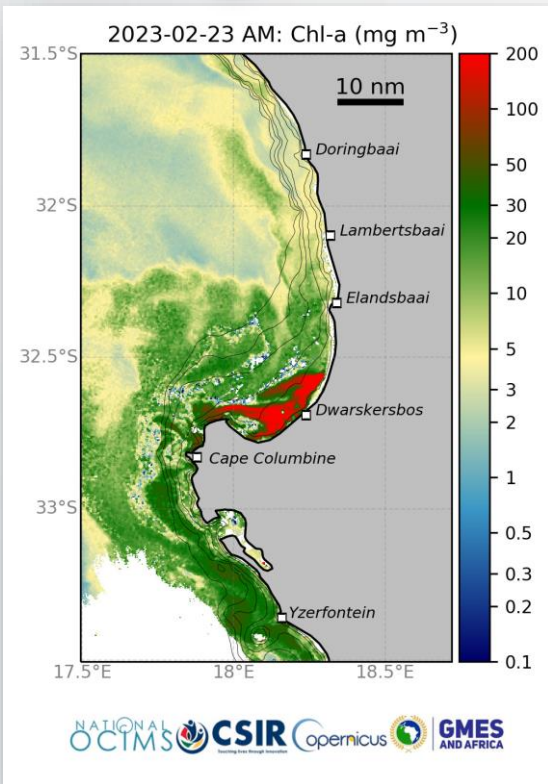
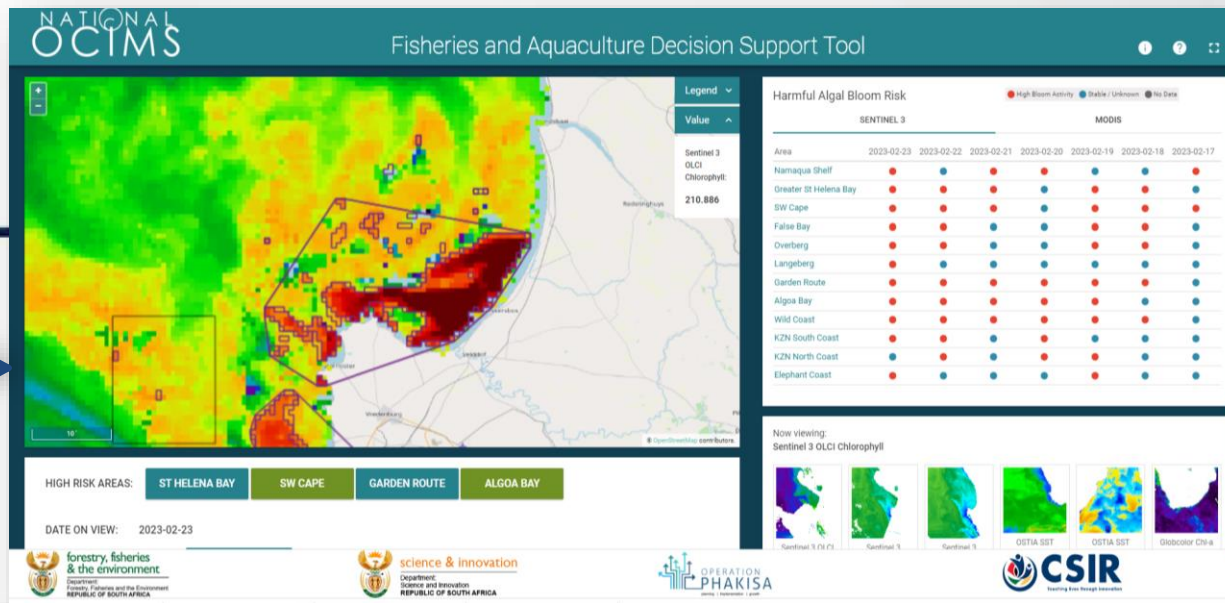


Harmful Algal Bloom support example

Regional WhatsApp groups

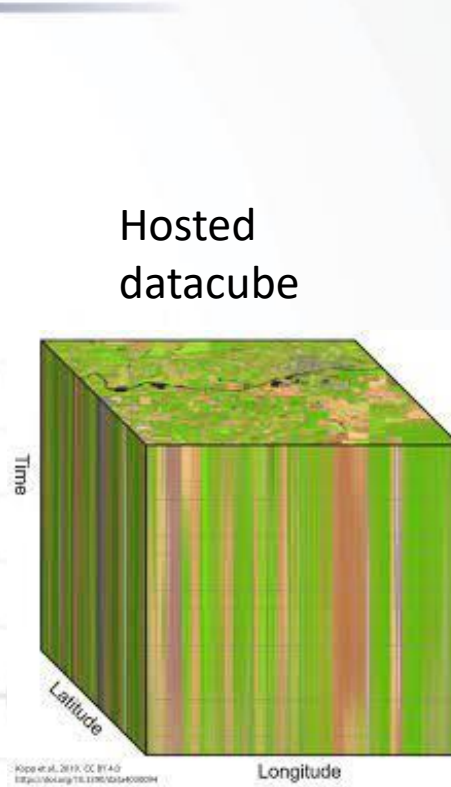
OCIMS Fisheries and Aquaculture Decision support tool

OCIMS/EO4WQ Water Quality tool



Upcoming: Improved data access & tools

- Fully exploit the analysis of satellite data
- Datacubes: multidimensional data infrastructure used to store, manage and access marine data
- Facilitates the immediate use and impact of these data
- Minimizes the time, knowledge, and computational power previously required to use satellite data
- Analysis ready data can support fast generation of marine environmental information & policies



Download
spatio-
temporal
subsets



Access &
Analyze
online

Plot &
Visualise
indices

Current *information* access

- ✓ 1km, 300m, 20m Chl-a (blooms) available via the OCIMS map-based DeSTs
- ✓ 300m Chl-a & phytoplankton maps available as png images on the CSIR Ocean Colour tumblr

x No setup to access raw data

Upcoming *data* access

- ✓ Additional 300m & 20m Total suspended matter (plumes) maps via the OCIMS map-based DeSTs
- ✓ All ocean colour data products available as analysis ready datacubes
- ✓ Ability to download a spatio-temporal subsets
- ✓ API access

Thank you!

MSmith2@csir.co.za



science & innovation

Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA



forestry, fisheries
& the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA



CSIR

Touching lives through innovation



National
Research
Foundation



SOUTH AFRICAN NATIONAL
SPACE AGENCY