

SOMISANA: A Sustainable Ocean Modelling Initiative: A South African Approach

Jennifer Veitch
South African Environmental Observation Network



Operational oceanography for well-informed decision making



Operations Phakisa and the Oceans Economy



An initiative to 'fast-track' the implementation of solutions highlighted as issues in the National Development Plan 2030

Six work streams:

1. Marine Transport and Manufacturing
2. Offshore Oil and Gas Exploration
3. **Marine Protection Services and Ocean Governance**
4. Small Harbours
5. Coastal and Marine Tourism

OPERATION PHAKISA | OCEANS ECONOMY

What is Operation Phakisa?

Why Oceans Economy matters:

from the public and private sectors, academia as well as civil society organisations together to collaborate in: detailed problem analysis; priority setting; intervention planning; and delivery.

Why the Oceans Economy matters:

South Africa has a coastline of **3 900 km** including the sub-antarctic islands. We also have an Exclusive Economic Zone (EEZ) of **1.5 million** square kilometres. The Oceans Economy is a key sector for South Africa's economic future. Over the next decade, it is expected to contribute significantly to the country's GDP. Around 60% of the country's energy requirements are met by coal. South Africa has a proven oil reserve of **60 trillion** cubic feet of gas which is equivalent to 375 years of gas consumption.

The Aquaculture sector has the potential to grow sector revenue to **R3 billion**, and produce **15 000 jobs** by 2019. These are real opportunities for the country.

Potential to contribute up to R177 billion to SAs GDP by 2033 and to create over a million jobs




Together moving South Africa's Oceans Economy Forward

Tel: +27 (0)12 312 0000 Website: www.operationphakisa.gov.za or www.environment.gov.za Email us: oceansphakisa@environment.gov.za

The Oceans and Coastal Information Management System

Marjolaine Krug, OCIMS manager, DFFE



-  Harmful Algal Bloom
-  Ops at Sea
-  Coastal Flood Hazard
-  Integrated Vessel Tracking
-  Coastal Viewer
-  Marine Spatial Planning
-  Water quality
-  Oil spill / Bilge Detection
-  Fisheries Support

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

Science aimed at societal issues and in support of institutional decisions

The Oceans and Coastal Information Management System



2016: HAB event costs the aquaculture industry R70m



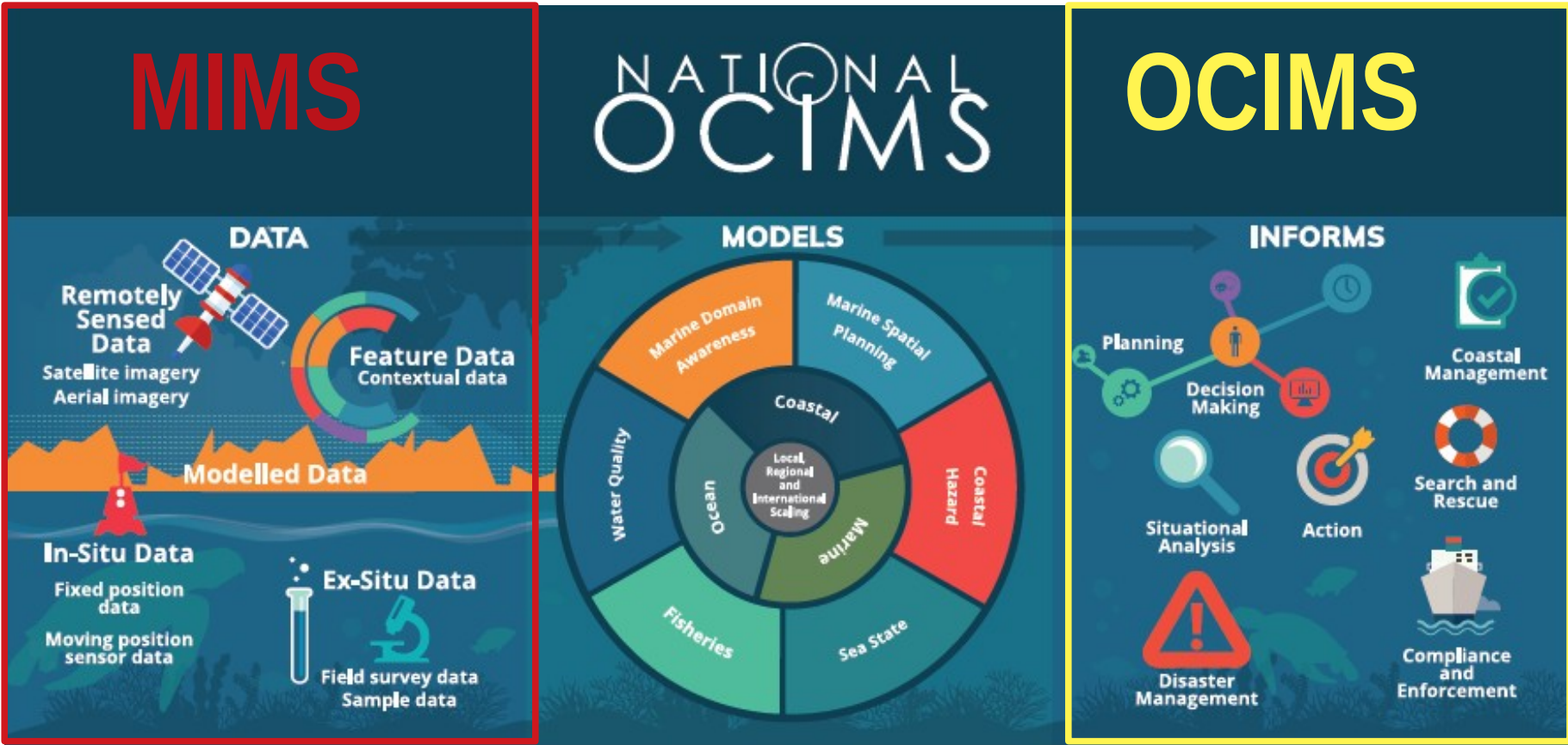
NATIONAL OCIMS Harmful Algal Bloom Decision Support Tool

Area	2018-11-24	2018-11-23	2018-11-22	2018-11-21	2018-11-20	2018-11-19	2018-11-18
Namaqua Shelf	High	High	High	Stable	Stable	Stable	No Data
Greater St Helena Bay	High	High	High	High	High	High	No Data
SW Cape	High	High	High	High	High	High	No Data
False Bay	High	High	High	High	High	High	No Data
Overberg	High	High	High	High	High	High	No Data
Langeberg	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Garden Route	High	High	High	High	High	High	High
Algoa Bay	High	High	High	High	High	High	High
Wild Coast	No Data	High	High	High	High	High	High
KZN South Coast	High	High	High	High	High	No Data	No Data
KZN North Coast	High	High	High	High	High	High	High
Elephant Coast	No Data	No Data	No Data	No Data	No Data	No Data	No Data

Now viewing: Blooms from Chl-A analysis



The Marine Information Management System



SOMISANA

The Sustainable Ocean Modelling Initiative: a South AfricaN Approach

Jennifer Veitch, SOMISANA lead, SAEON

VISION

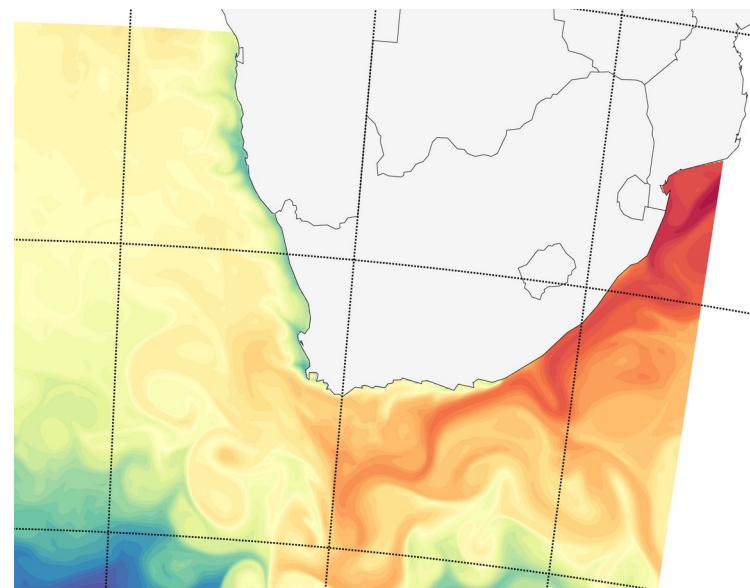
A sustained and transformed **critical mass** of internationally recognized South African numerical ocean modelling experts who provide **accurate information** about the changing state of the ocean for **enhanced impact**.

MISSION

An ocean modelling hub and platform that promotes the **inclusive development of local expertise** and that produces and provides **state-of-the-art ocean information, tools and research** that is **visible and accessible to all**.

GOAL

- 1. **Modelling developments:**
 - Limited domain regional OFSS
 - Optimized hindcasts
 - 2. **Capacity development:**
 - student supervision, workshops etc ..
- } **OCIMS**



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GOAL: Capacity Development

Student supervision as part of collaborative projects:

Realistic, coupled hydrodynamic-biogeochemical modelling

Data assimilation

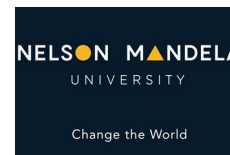
Lagrangian-particle tracking

High frequency, high resolution bay-scale modelling

Analysis of model output

Model evaluations

	Hons.	MSc	PhD	Postdoc
Graduated	4	3	2	1
Current	0	2	5	



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GOAL: Capacity Development

Funded: Three-year NRF-IRD project to develop ocean modelling capacity via:

- workshops and training schools
- mobility for collaborative projects

Proposed: A BRICS Predicted Ocean: Roadmap and Demonstration of model validation, intercomparisons and applications for sustainable management of the coastal ocean.

- workshops and training schools
- engagement with HDIs to *co-develop* coursework

SUSTAINED SOLUTIONS!



The poster features logos for CROCO (Coastal and Regional Ocean Community Model), Agencia Nacional de Investigación y Desarrollo (Gobierno de Chile), IRD (IRD), NRF (National Research Foundation), SAEON (South African Environmental Observation Network), LEGOS (National Integrated Cyberinfrastructure System), and CHPC (National Integrated Cyberinfrastructure System).

SECOND ANNOUNCEMENT
2022 CROCO SPRING TRAINING

The Coastal and Regional Ocean Community Model
(venue: CHPC, Rosebank, Cape Town, South Africa)

1. Basic course
17-21 October 2022

2. Advanced course
24-28 October 2022

There is no course fee!
Limited funds available for travel and accommodation (participants within SA only)

Organizers:
Dr. Jennifer Veitch (SAEON, SA)
ja.veitch@saeon.nrf.ac.za
Dr. Lionel Renault (IRD, France)
Lionel.renault@ird.fr

Prerequisites:
Basic: A basic knowledge of physical oceanography, experience with Matlab/Octave, optionally Python. Knowledge of the Linux OS.
Advanced: As above plus experience with numerical modelling (preferably CROCO, but also WRF, PISCES)

Places are limited (20 in person max. + 10 virtual!)
Apply using the link below by **15 July**
<https://forms.gle/U7AN9dWUvrEmKAHL9>

Logos at the bottom include: cnrs, UNIVERSITA STATALE DELL'ABRUZZO, LOPS, science & innovation (Department: Science and Innovation, REPUBLIC OF SOUTH AFRICA), and LOCEAN.

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GOAL: Contribution to OCIMS

1. Adding value to existing operational satellite and model products

Matt Carr and Cristina Russo, Ocean Product developers
Core and edges of Agulhas Current

Distance of Agulhas Current from major ports

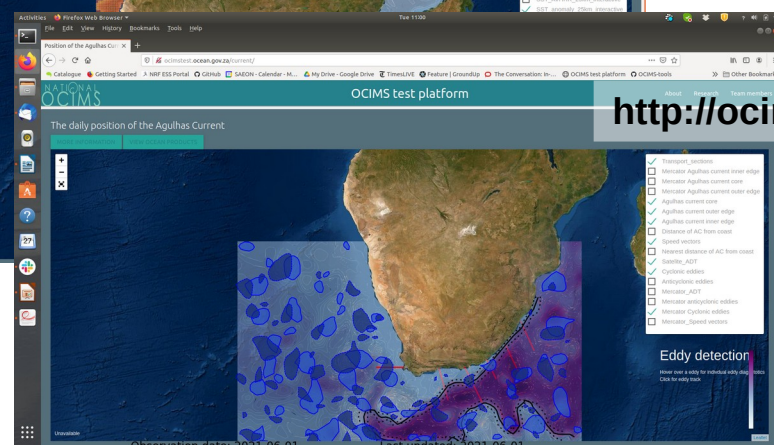
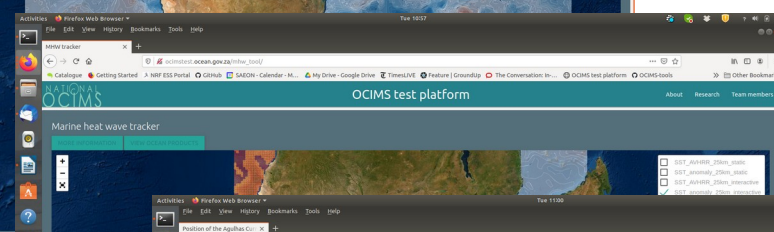
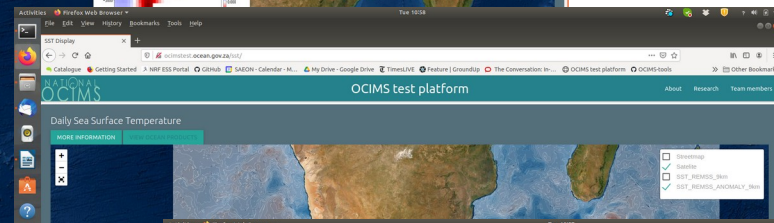
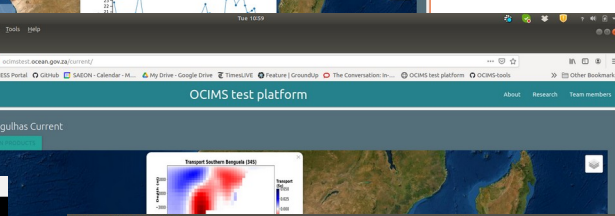
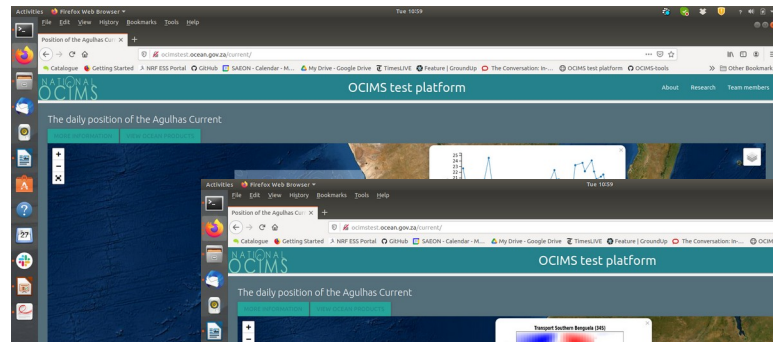
Current transports

SST anomalies

Marine heat waves

Eddy tracking

<http://ocimstest.ocean.gov.za/>



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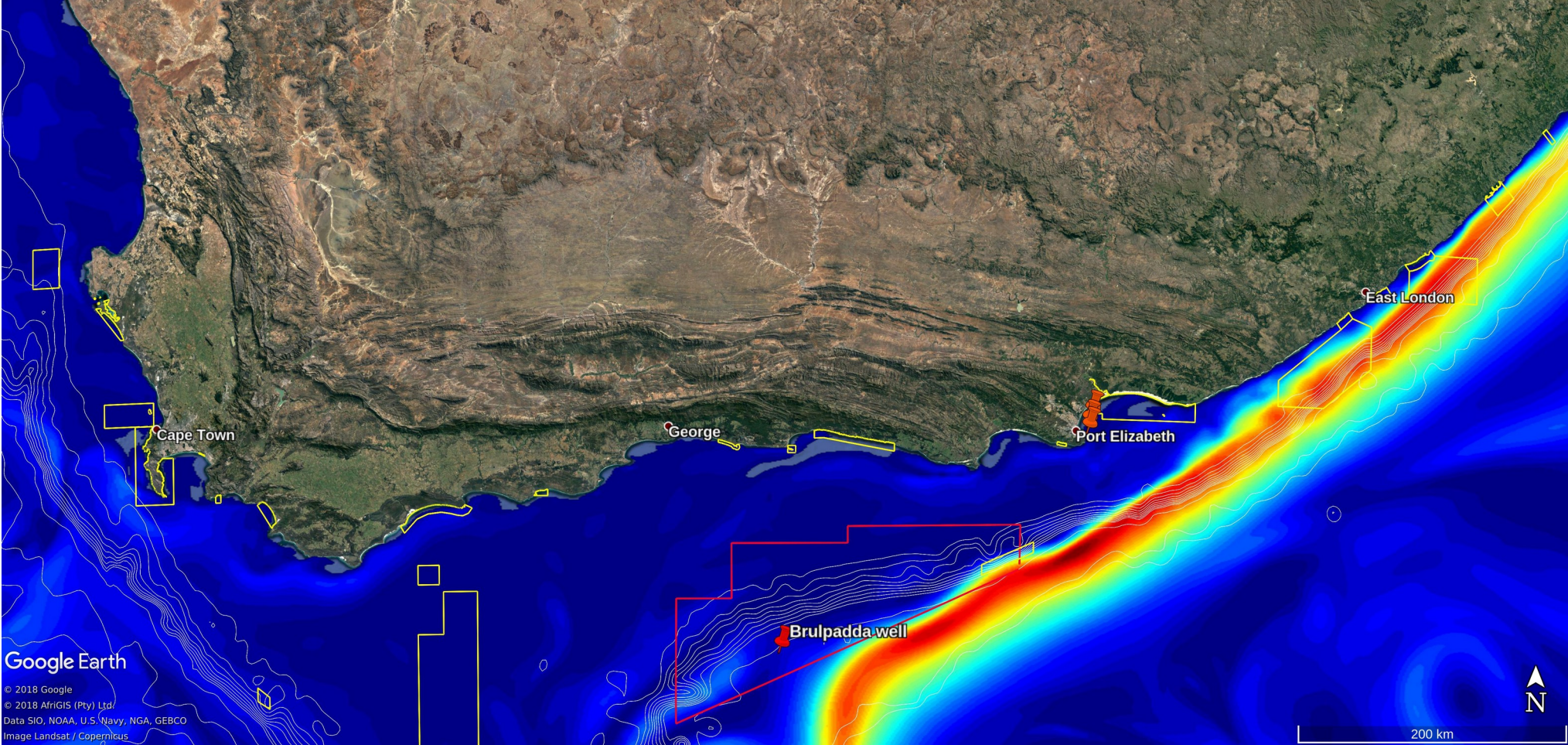
04/02/2021 01/03/2021

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GOAL: Contribution to OCIMS

2. Downscaling global forecast models, optimized for key coastal regions

Giles Fearon, Model Developer



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GOAL: Contribution to OCIMS

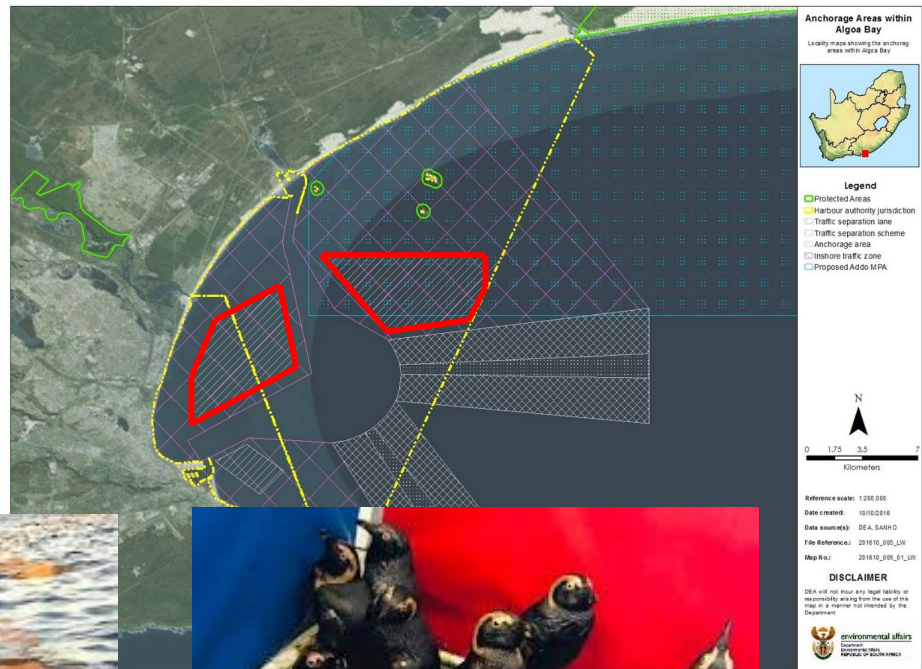
2. Downscaling global forecast models, optimized for key coastal regions

Giles Fearon, Model Developer

Limited-domain operational ocean forecast system (OOFs): Algoa Bay as a pilot



www.raggycharters.co.za



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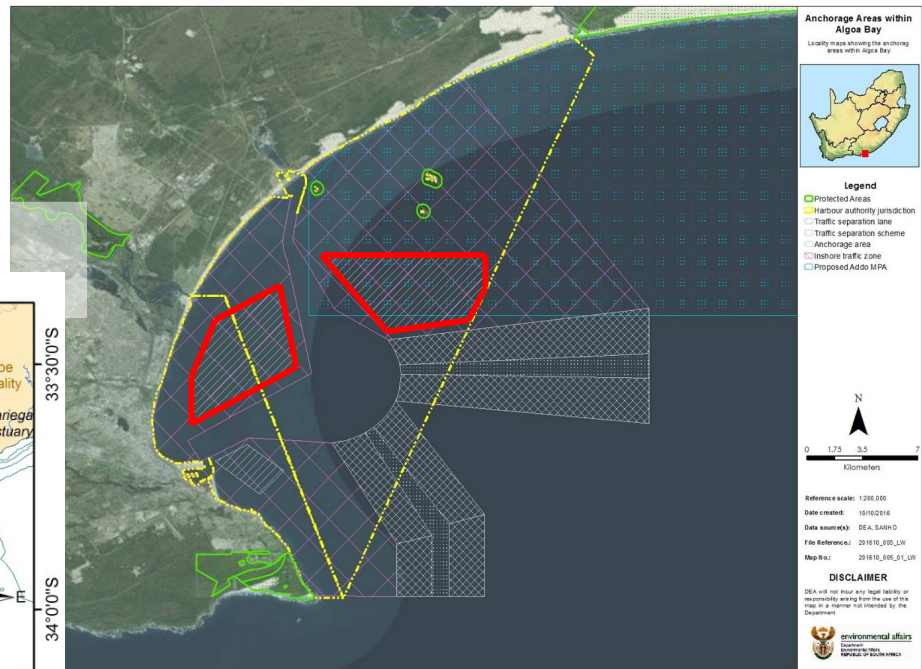
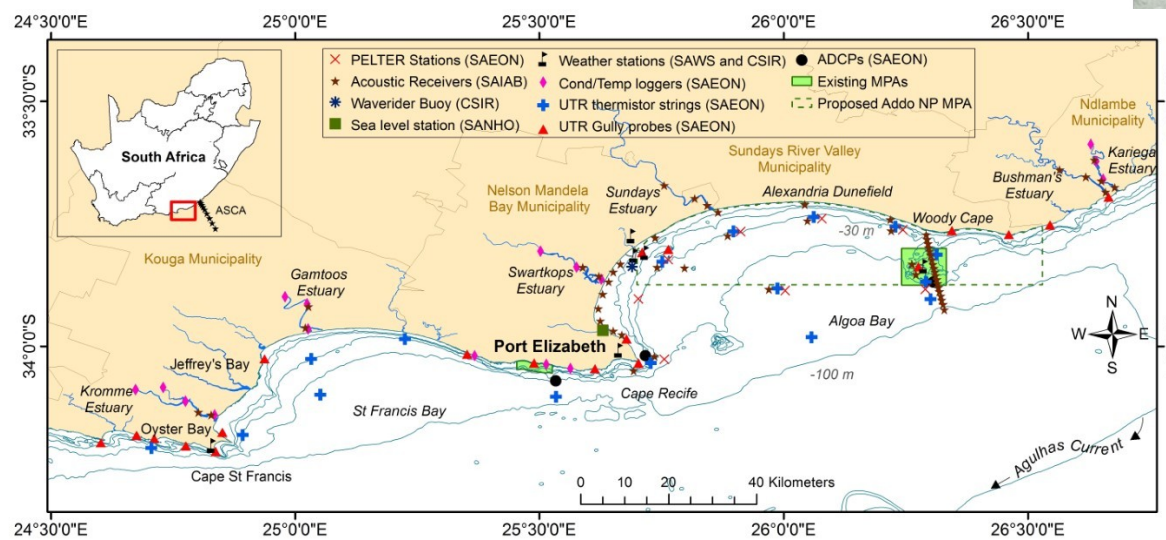
GOAL: Contribution to OCIMS

2. Downscaling global forecast models, optimized for key coastal regions

Giles Fearon, Model Developer

Limited-domain operational ocean forecast system (OOFs):
Algoa Bay as a pilot

SAEON SMCRI* sentinel site and therefore relatively data-rich



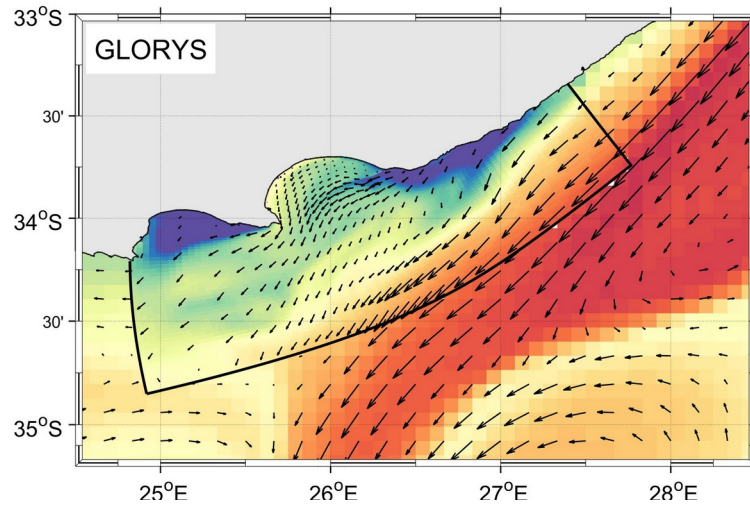
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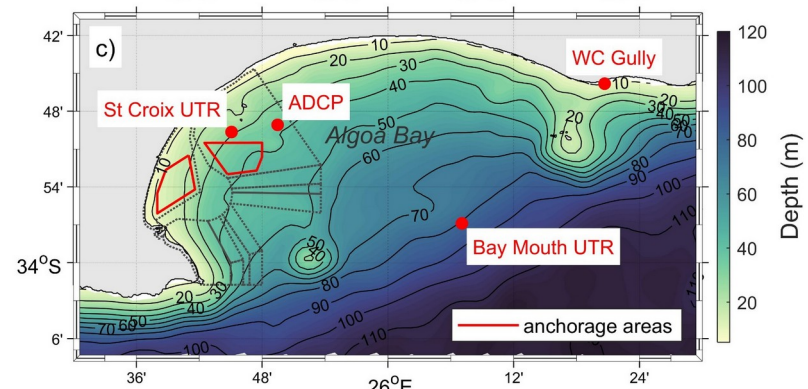
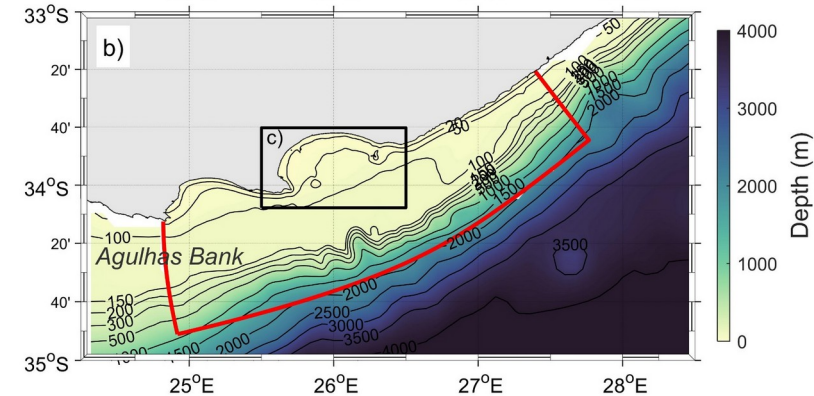
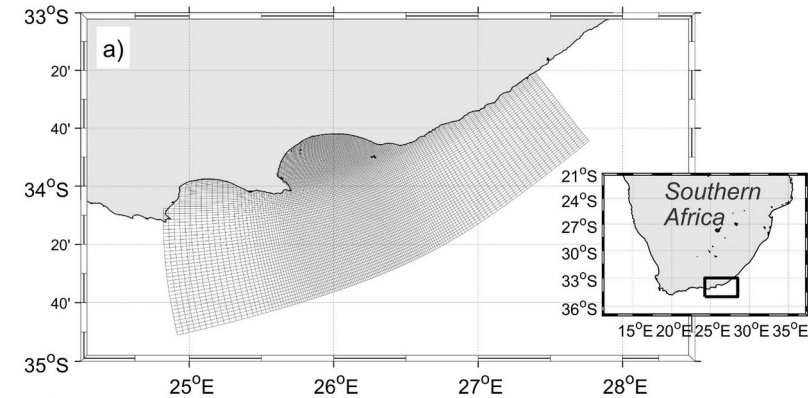
2. Downscaling global forecast models, optimized for key coastal regions

Giles Fearon, Model Developer

Limited-domain operational ocean forecast system (OOFS): Algoa Bay as a pilot



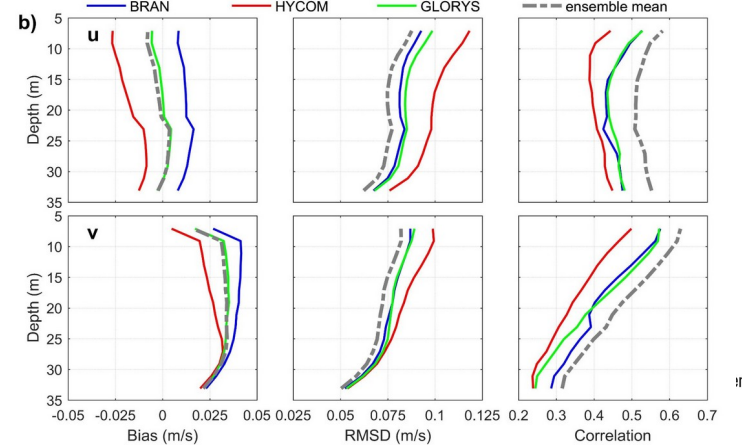
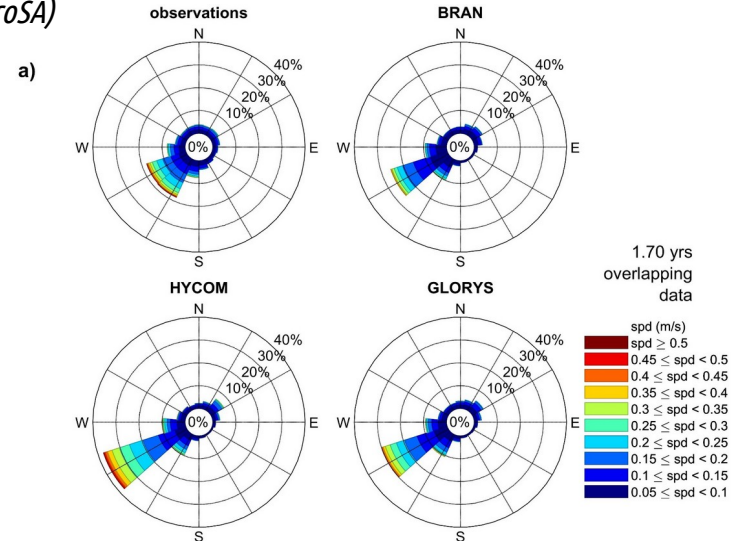
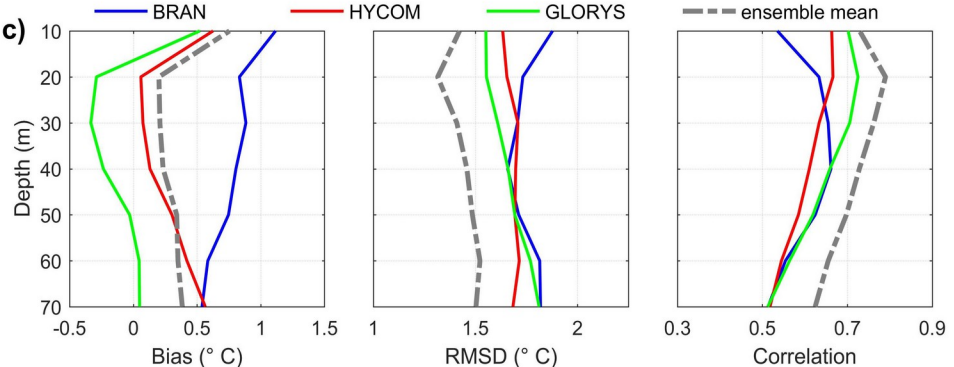
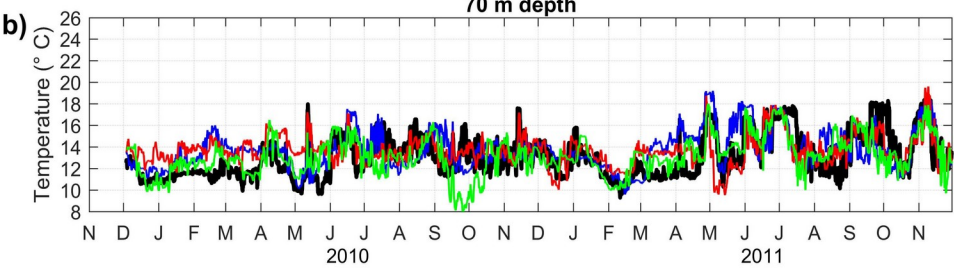
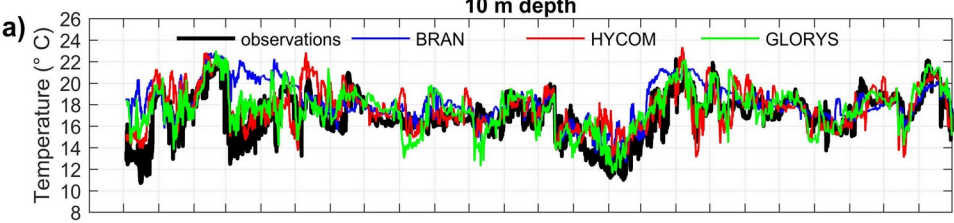
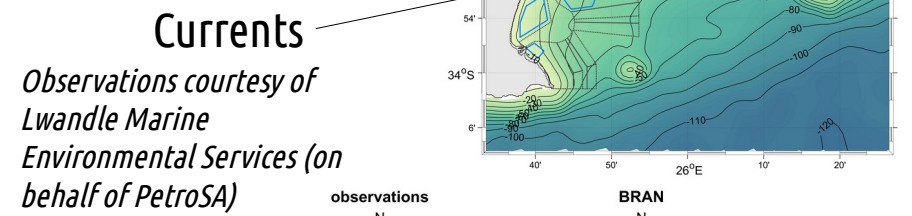
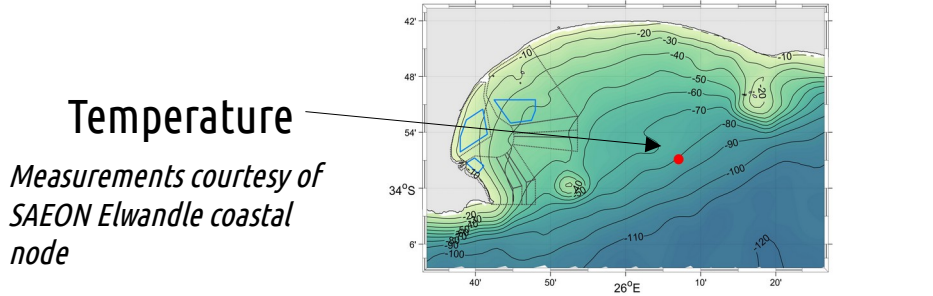
- Developed with the Coastal and Regional Ocean COmmunity model (CROCO) – NO assimilation
- Atmospheric forcing: GFS 30 km forecasts
- Boundary forcing: ~ 7-9km GLORYS forecasts
- **EASY TO IMPLEMENT AND RELOCATE**



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GOAL: Contribution to OCIMS

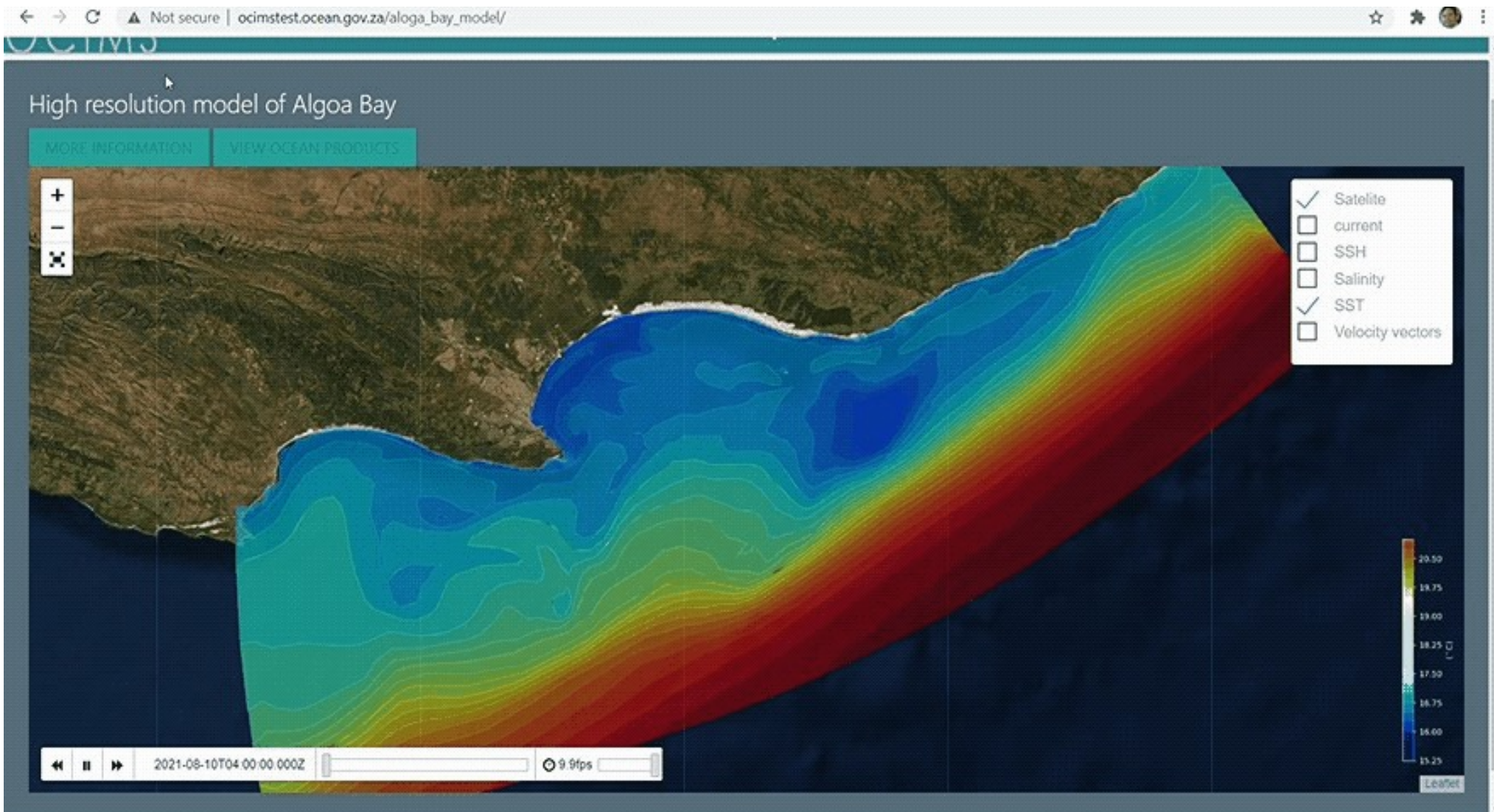
2. Downscaling global forecast models, optimized for key coastal regions
 Testing the model configuration in hindcast mode



Limited area operational forecast system: Algoa Bay

- Forecast generated once per day, from 5 days into the past to 5 days into the future
- Model boundary conditions from CMEMS, surface forcing from GFS

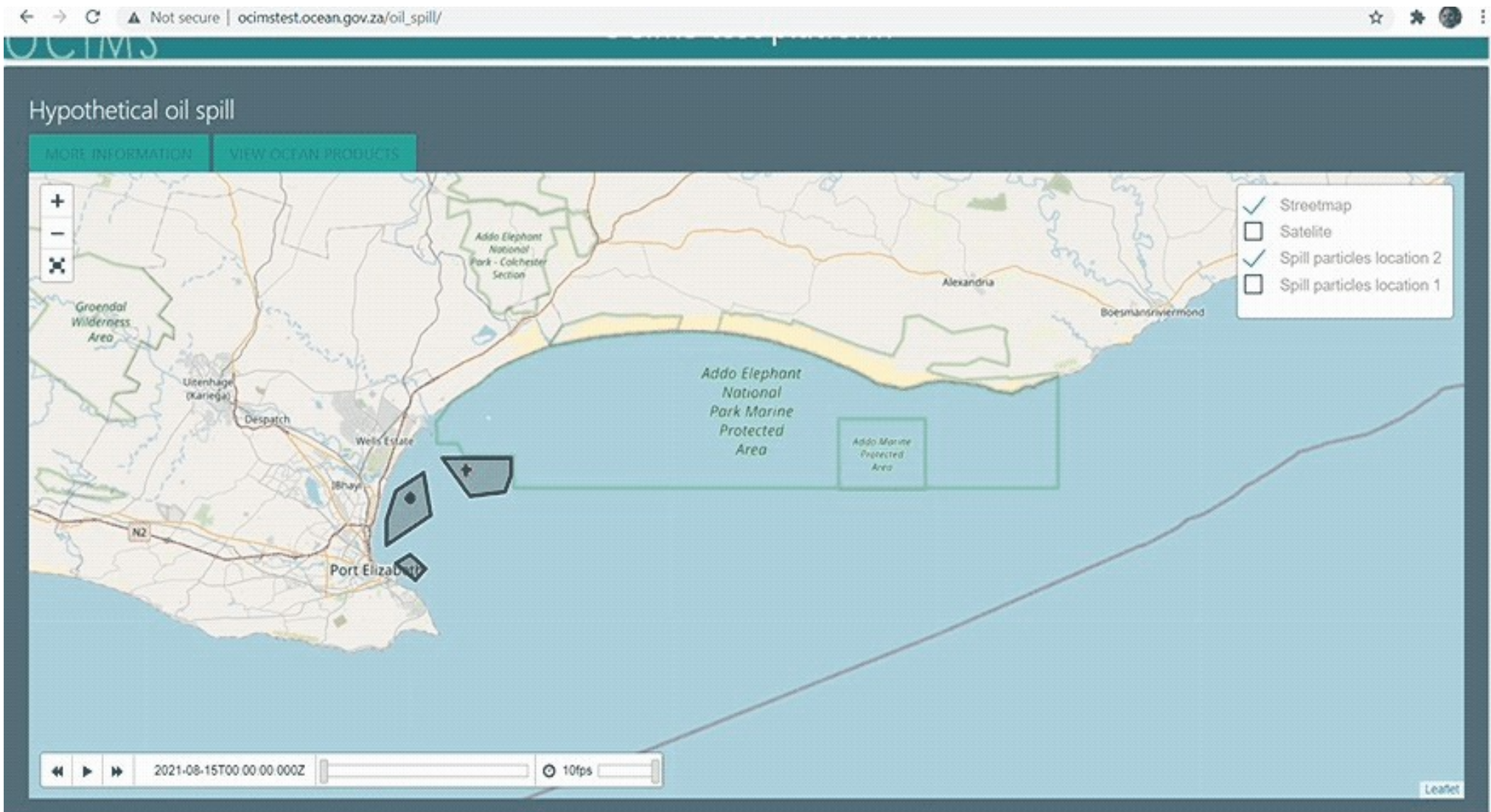
<http://ocimstest.ocean.gov.za/>



Limited area operational forecast system: hypothetical surface oil spills

- Particles advected using OceanParcels (<https://oceanparcels.org/>)
- Forced by CROCO surface currents and 3% of GFS 10 m winds

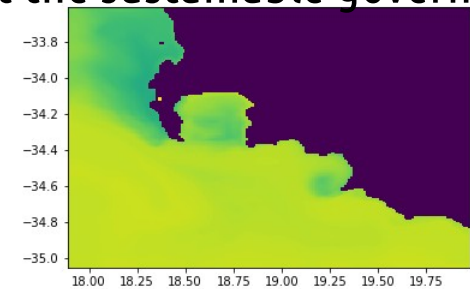
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Limited area operational forecast system

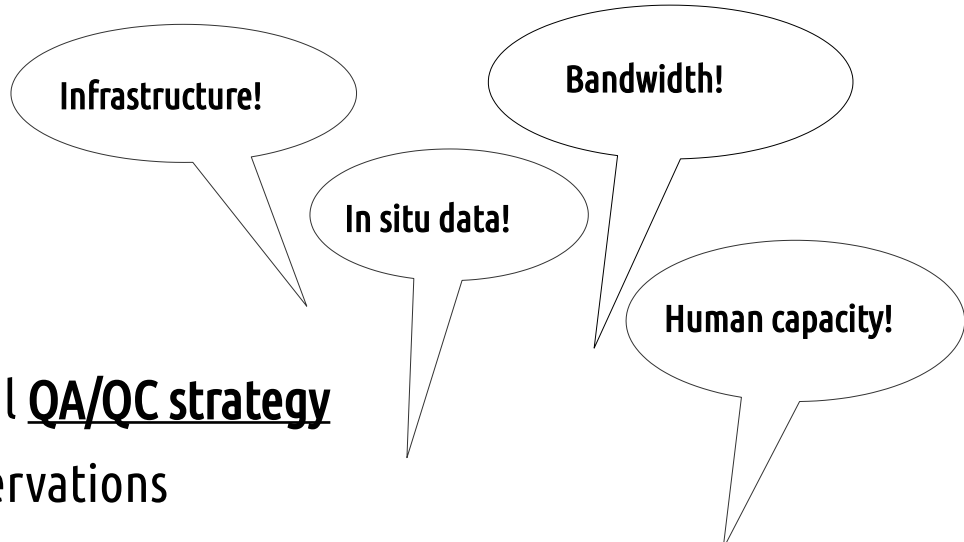
List of things to do

- Validation of the ocean forecast and an operational **QA/QC strategy**
- Include model **assimilation** of real-time in-situ observations
- **Improve the oil spill** component of the system (oil weathering and oil-shoreline interaction) and allow for user-specified spill parameters (e.g. time, location, volume, spill duration, oil type)
- Move to **higher resolution atmospheric forecasts** to force the ocean model e.g. from SAWS UM
- Development of **user-defined visualizations**
- Estuary-/Harbour- scale **Delft3D downscaling**
- **Ongoing stakeholder engagement and feedback** to ensure that products suit the needs of end-users for maximum socio-economic impact as well as to support the sustainable governance of our oceans and coasts.
- **Apply to other areas of interest** (Southwestern cape coast under construction)

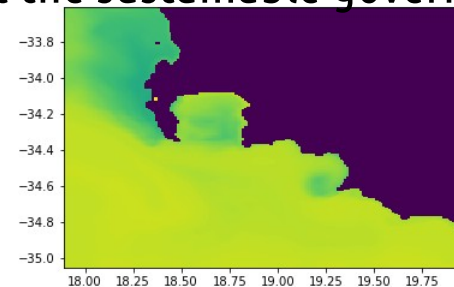


Limited area operational forecast system

List of things to do, challenges



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Limited area operational forecast system

List of things to do, challenges ...

or opportunities?

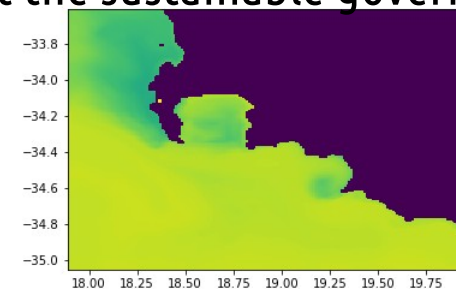
Infrastructure!

Bandwidth!

In situ data!

Human capacity!

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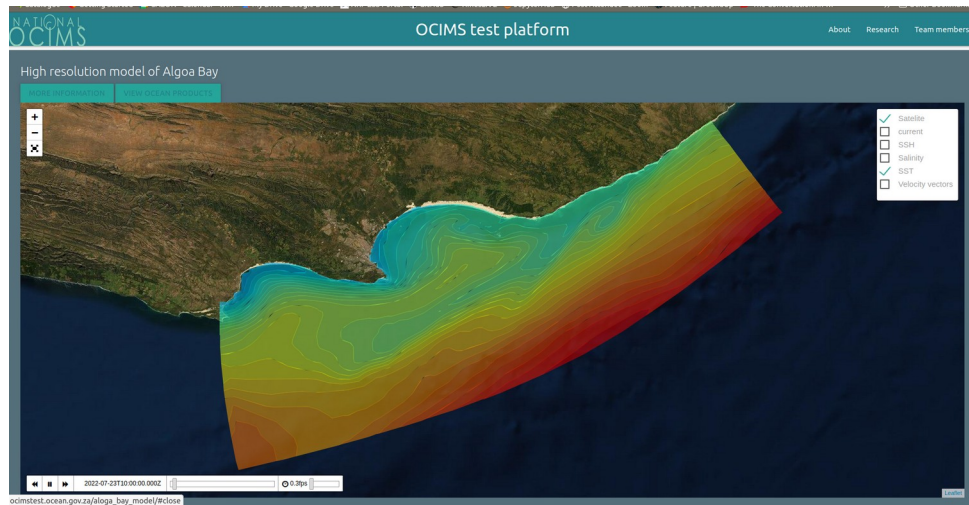


SAEON
South African Environmental
Observation Network

SOMISANA

From local development to global relevance

Local development that supports bespoke solutions designed for the specific challenges and needs of under-resourced nations



CoastPredict

toward a more resilient society

ForeSea

making ocean prediction more impactful and relevant

DITTO

A shared capacity to access, manipulate, analyze, visualize and effectively use marine information.

Thank you
ja.veitch@saeon.nrf.ac.za

