

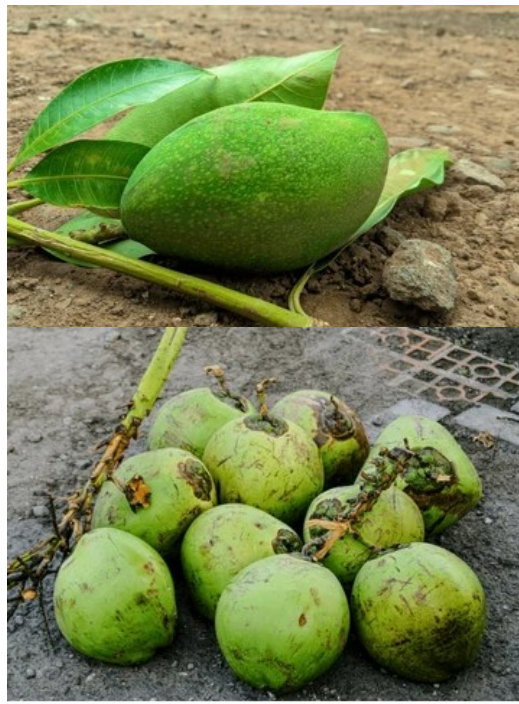
Emerging Systems for a Sustainable Blue Economy: Transforming Data into Actionable Intelligence

Jennifer Veitch

South African Environmental Observation Network (SAEON)

Francis Pavanathara

Indian National Centre for Ocean Information Services (INCOIS)



Indigenous early warning systems, Mozambique
Bol and van Niekerk, 2024



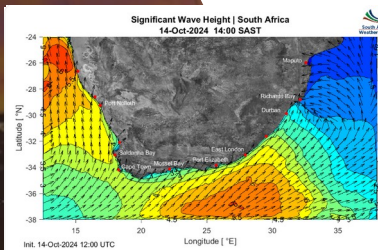
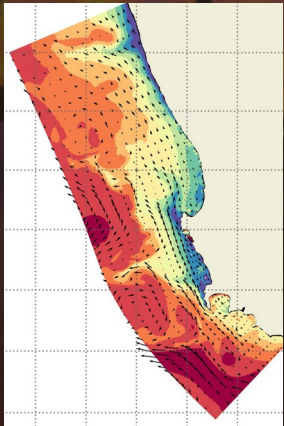
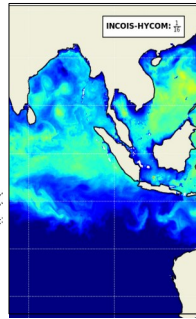
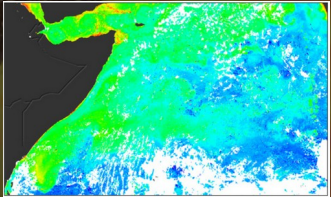
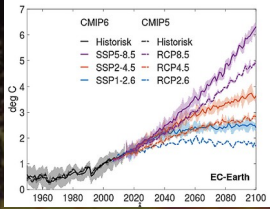


Kolu: A holistic conceptualization of all coastal hazards

Santha, 2014



Emerging Systems for a Sustainable Blue Economy: Transforming Data into Actionable Intelligence



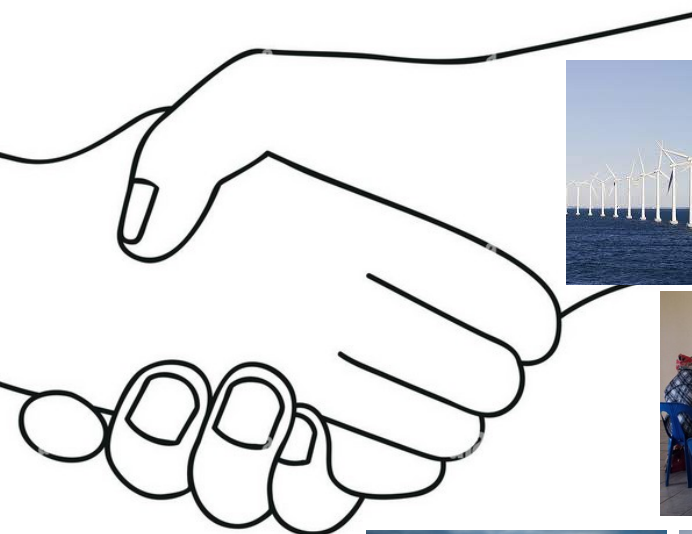
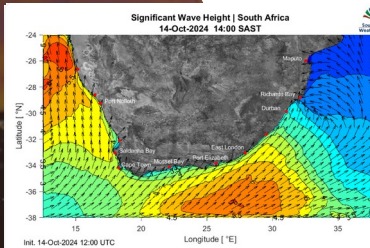
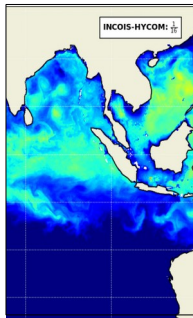
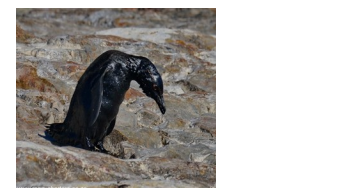
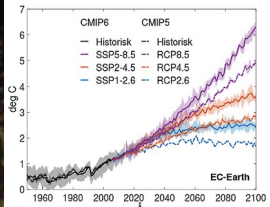
In partnership with



Emerging Systems for a Sustainable Blue Economy: Transforming Data into Actionable Intelligence

Actionable Intelligence: information that facilitates decision-making and action

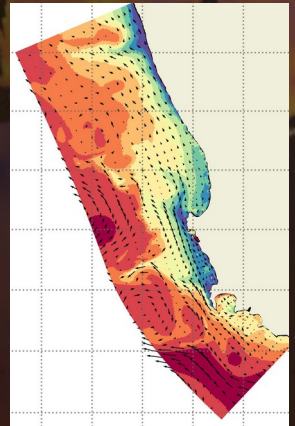
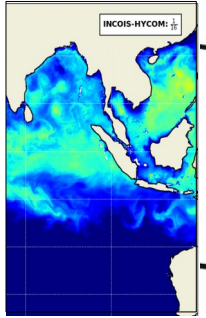
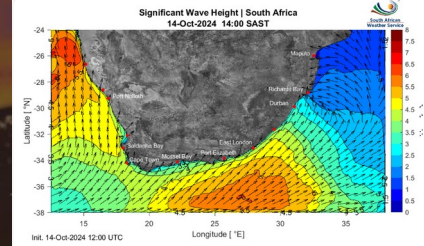
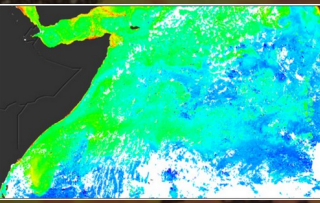
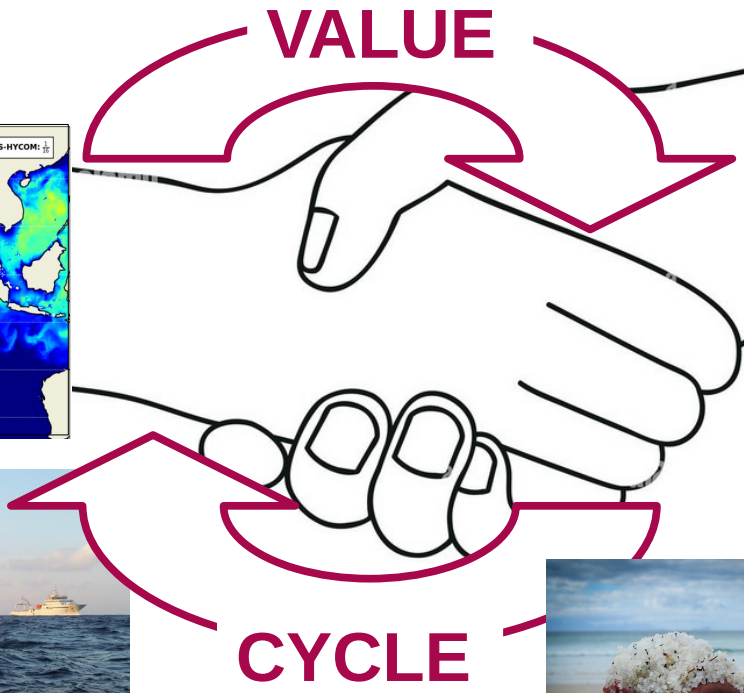
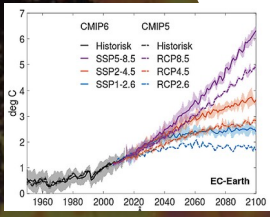
- ◆ Relevant
- ◆ Timely
- ◆ Clear
- ◆ Reliable



Emerging Systems for a Sustainable Blue Economy: Transforming Data into Actionable Intelligence

Actionable Intelligence: information that facilitates decision-making and action

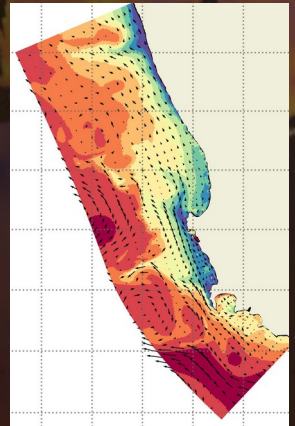
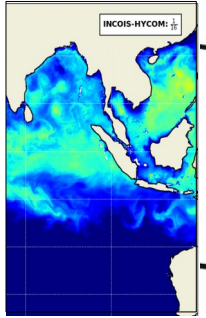
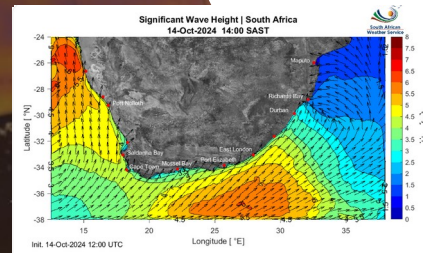
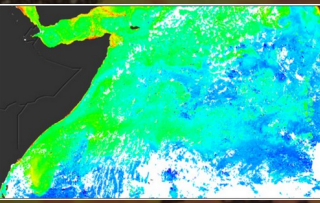
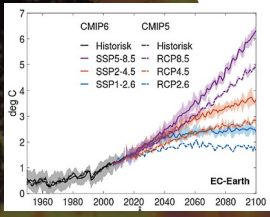
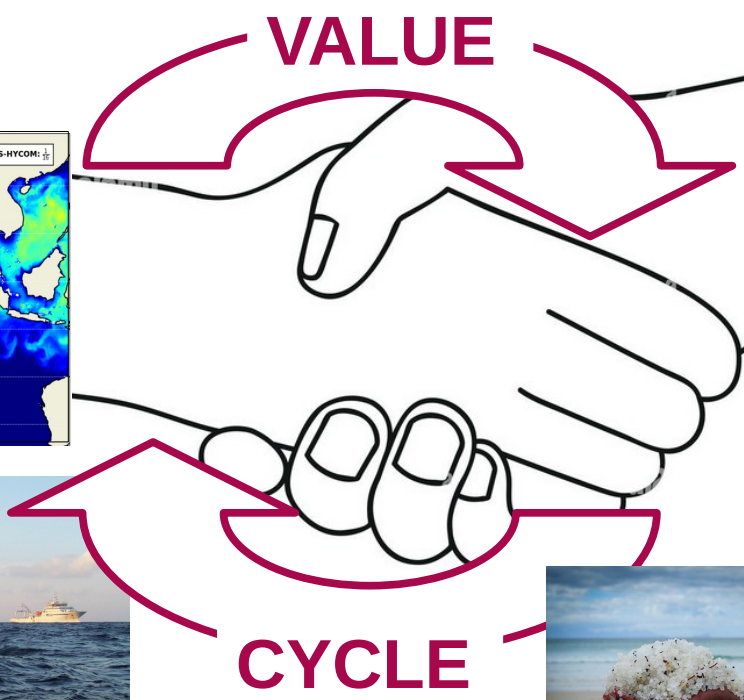
- ◆ Relevant
- ◆ Timely
- ◆ Clear
- ◆ Reliable



Emerging Systems for a Sustainable Blue Economy: Transforming Data into Actionable Intelligence

Blue Economy: 'The sustainable use of ocean resources for economic growth, jobs, improved livelihoods, while preserving the health of the ocean ecosystem' – World Bank.

- ◆ Innovative
- ◆ Inclusive
- ◆ Resilient



Emerging Systems for a Sustainable Blue Economy: Transforming Data into Actionable Intelligence



Emerging: Starting to exist, grow or become known.

- ◆ Potential
- ◆ Opportunity
- ◆ Rapidly growing
- ◆ Often under-resourced



In partnership with



Emerging Systems for a Sustainable Blue Economy: Transforming Data into Actionable Intelligence

Emerging: Starting to exist, grow or become known.

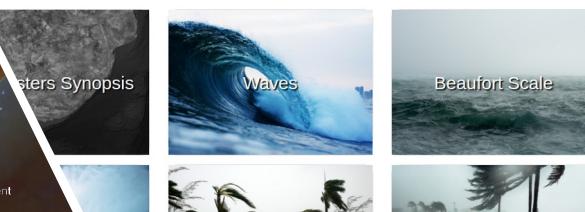
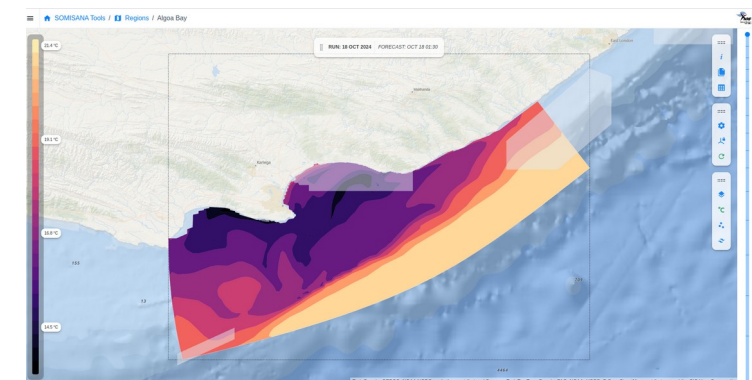
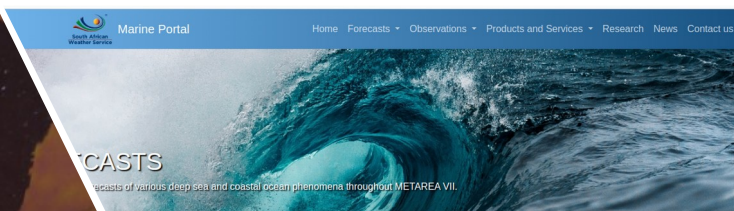
- ◆ Potential
- ◆ Opportunity
- ◆ Rapidly growing
- ◆ Often under-resourced

South Africa: SOMISANA est. 2019

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**.

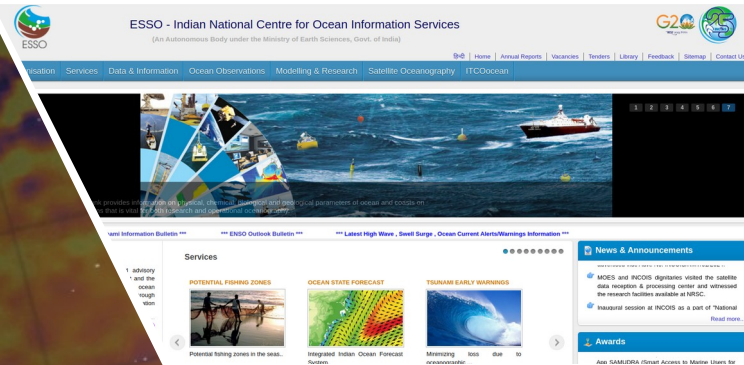
South Africa: SAWS Marine Portal est. 2019

State-of-the-art forecasts of various deep sea and coastal ocean phenomena throughout METAREA VII



Emerging Systems for a Sustainable Blue Economy: Transforming Data into Actionable Intelligence

Emerging: Starting to exist, grow or become known.



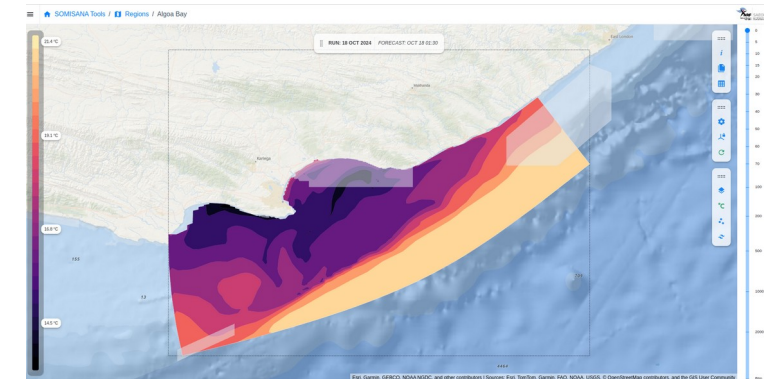
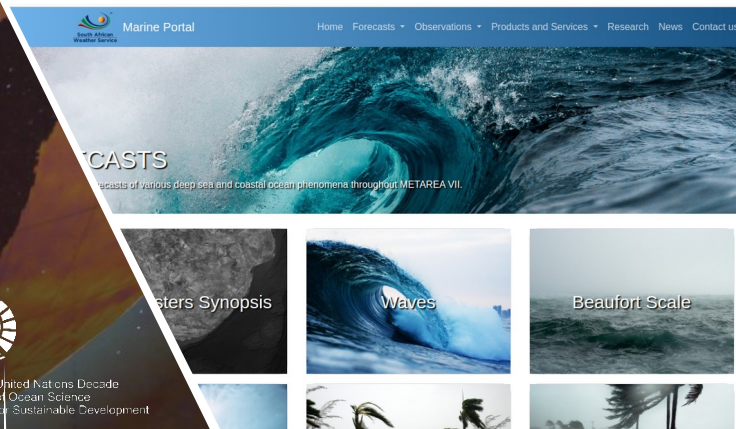
India: INCOIS est. 1999

To provide **ocean data, information and advisory services** to society, industry, the government and the scientific community through sustained ocean observations and constant improvements through systematic and focused research in information management and ocean modelling.

South Africa: SOMISANA est. 2019

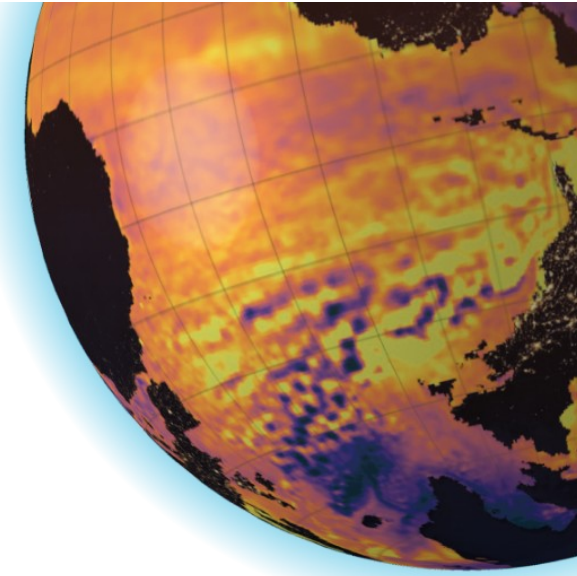
A **sustained** and transformed critical mass of internationally recognized South African numerical ocean modelling experts who provide **accurate information** about the changing state of the ocean for **enhanced impact**.

South Africa: SAWS Marine Portal est. 2019
State-of-the-art forecasts of various deep sea and coastal ocean phenomena throughout METAREA VII

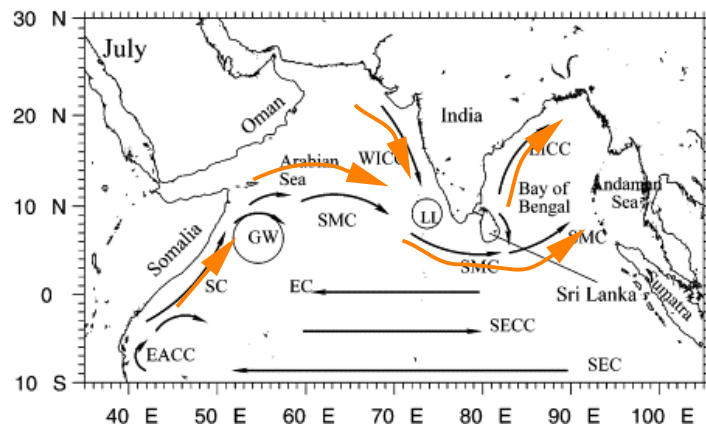
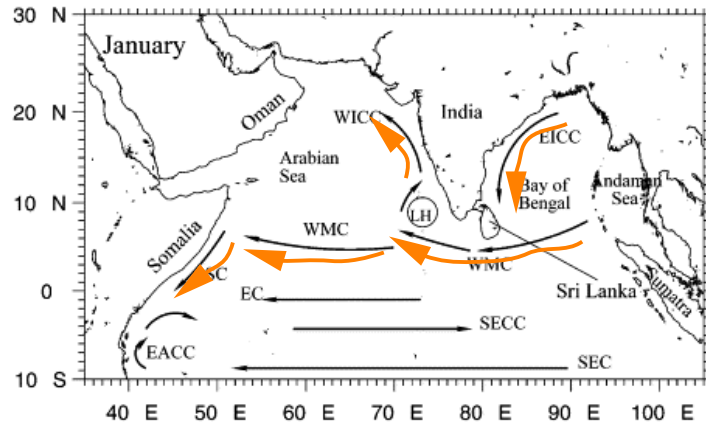


India's forecast system and services journey

Unique marine environment: monsoonal system

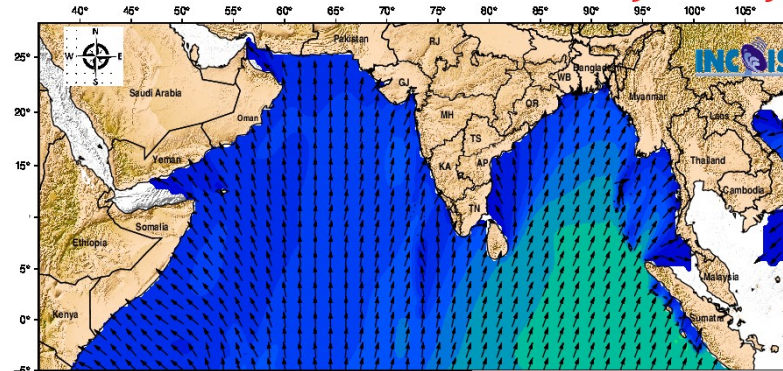


Currents



Waves

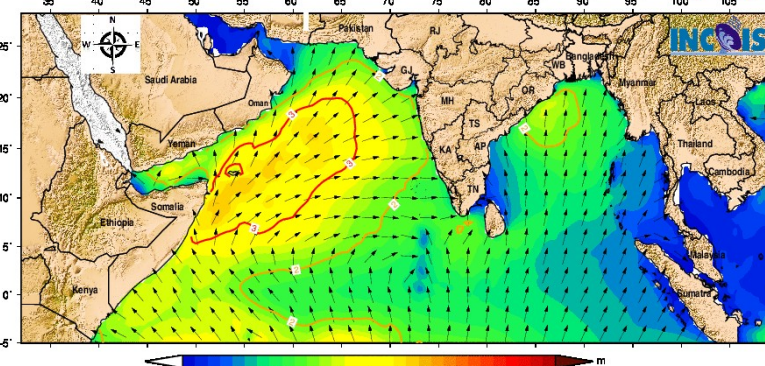
January



January



July

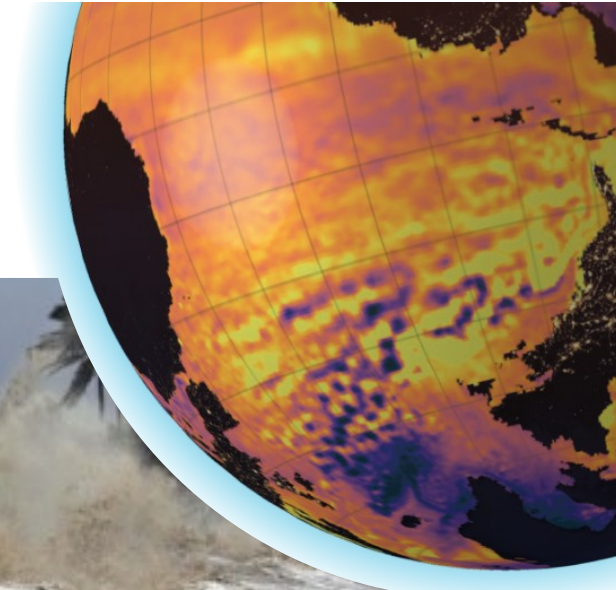


July



India's forecast system and services journey

Extreme marine hazards



Swell surge in sea off Kanyakumari kills five medicos

Arockiaraj Johnbosco / TNN / Updated: May 6, 2024, 17:42 IST

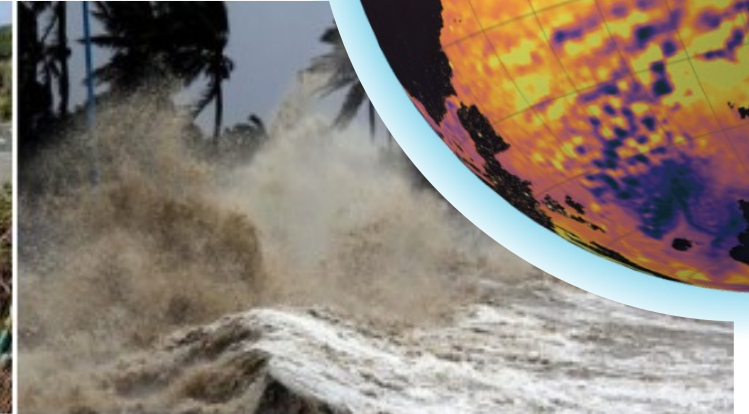
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Representative photo

MADURAI: Five medical college students and interns from SRM Medical College Hospital and Trichy Government Medical College Hospital vacationing in Kanyakumari district drowned in the sea off Lemur Beach on Monday due to a swell surge, a phenomenon the India Meteorological Department has been warning for the southern Tamil Nadu coast.

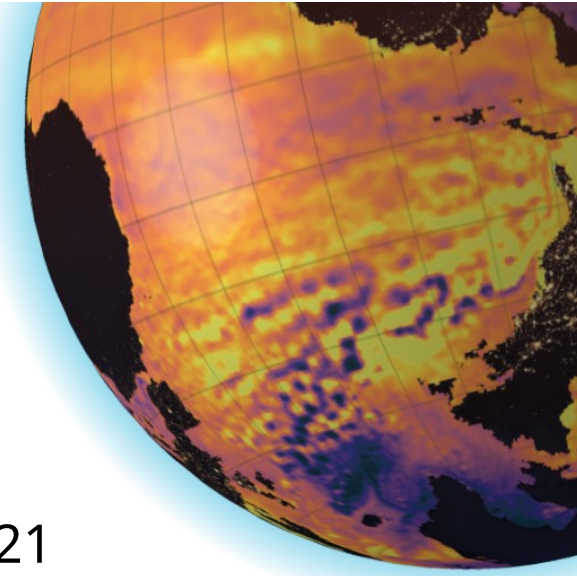
The deceased have been P Sarvadarshith, 23, of Parakkai in Kanyakumari district, M Praveen Sam, 23, of Oddanchatram in Dindigul district, B Gayathiri, 25, of Neyveli, Venkatesh, 24, of Andhra Pradesh, and D Charukavi, 23, of Thanjavur.



Times of India, 6 May 2024

India's forecast system and services journey

Extreme marine hazards



Cyclone Tauktae, May 2021



Deaths: 51

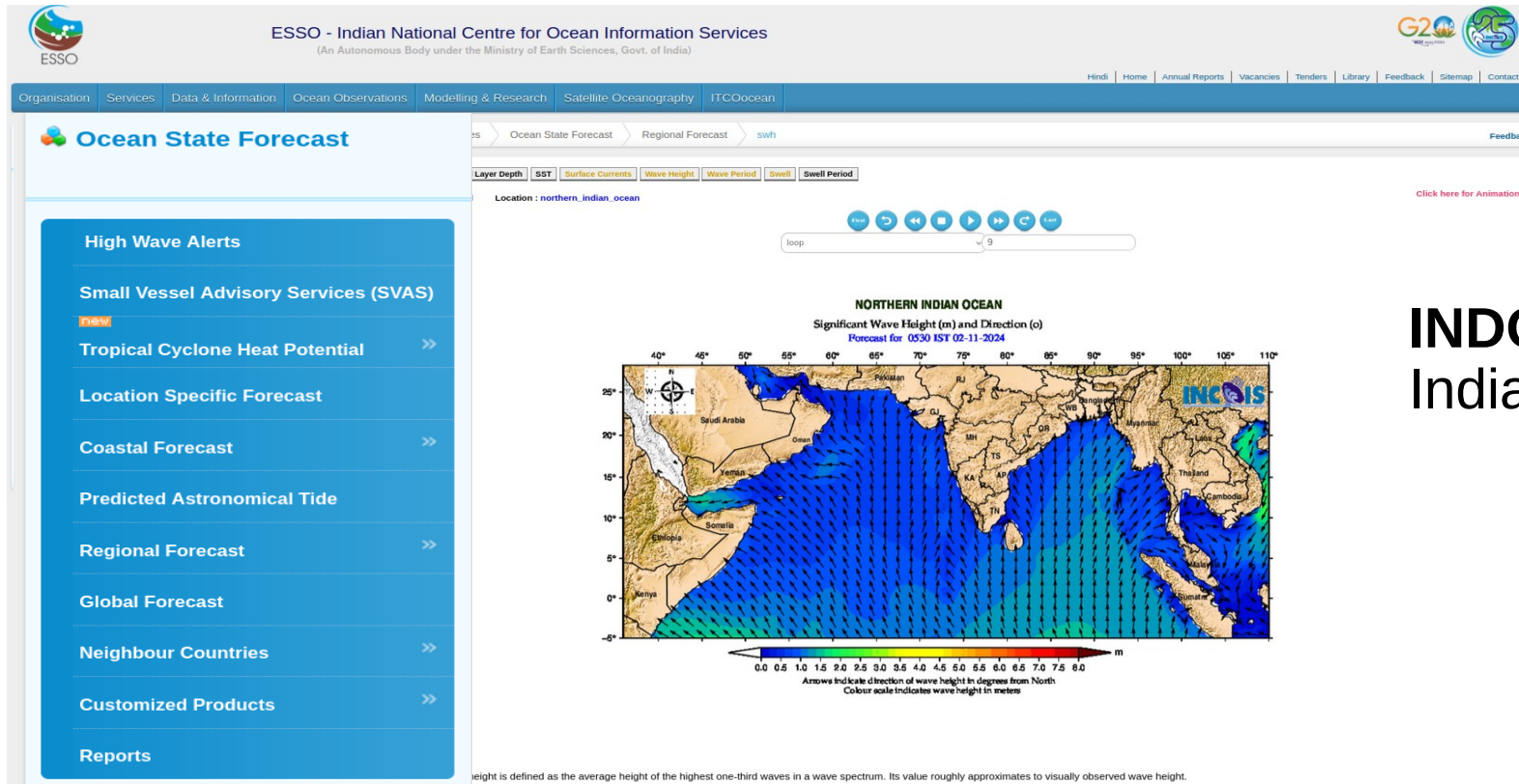
Missing: 21

Rescued: 180+

India's forecast system and services journey

INCOIS:

Indian National Centre for Ocean Information Services



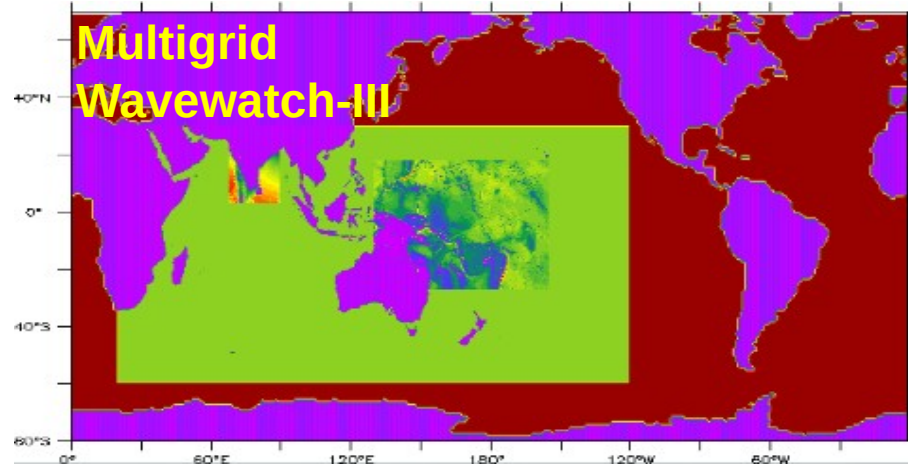
Catalyst: Government support and their recognition of the need for forecasting services

INDOFOS: Indian Ocean Forecast System

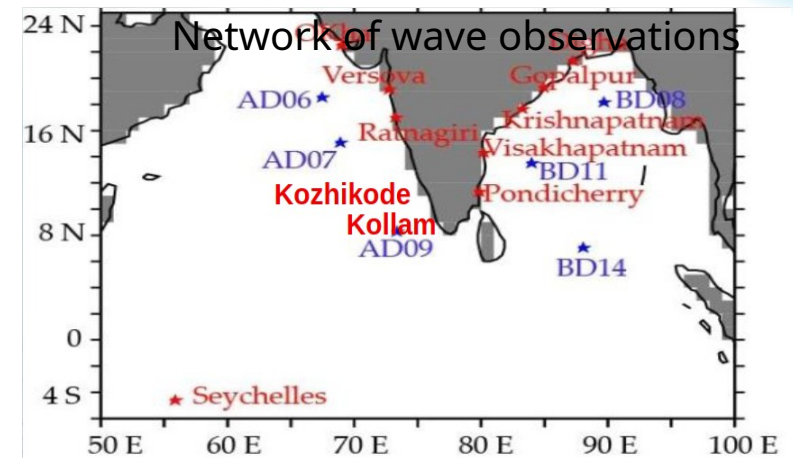


India's forecast system and services journey

INCOIS: Wave forecasts (est. 2005)



Success:
Sophisticated multi-grid assimilated WW3 system that supports storm surge predictions



Low res. WAM forecasts ———> Multi-grid assimilated WW3 ———> Integrated coastal inundation prediction system



India's forecast system and services journey

INCOIS: Current forecasts (est. 2010)

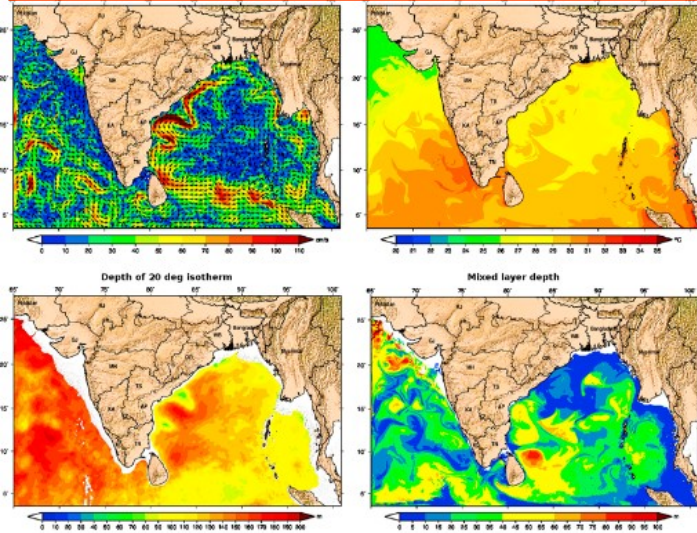
Simple approach:
Initial regional forecast system was unassimilated.

Indian Ocean Forecast System

Regional Ocean Analysis

Regional and coastal forecasts

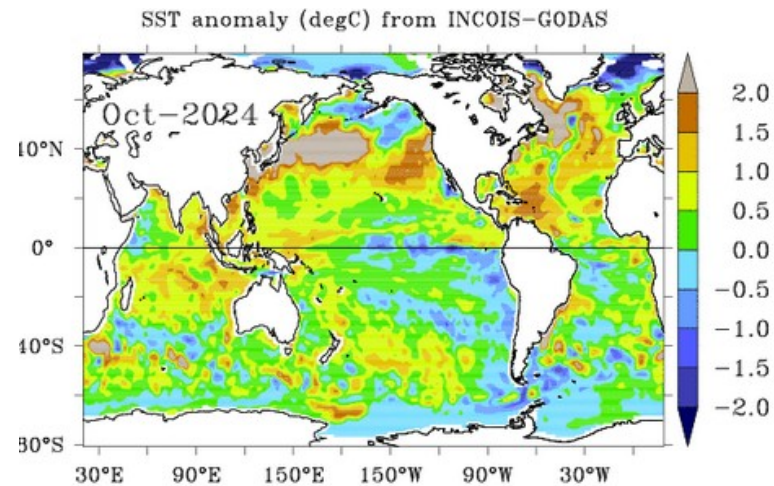
General circulation



Global Ocean Data Assimilation System

Ocean Initial Conditions

Ocean Analysis & Reanalysis



Monsoon Mission of India

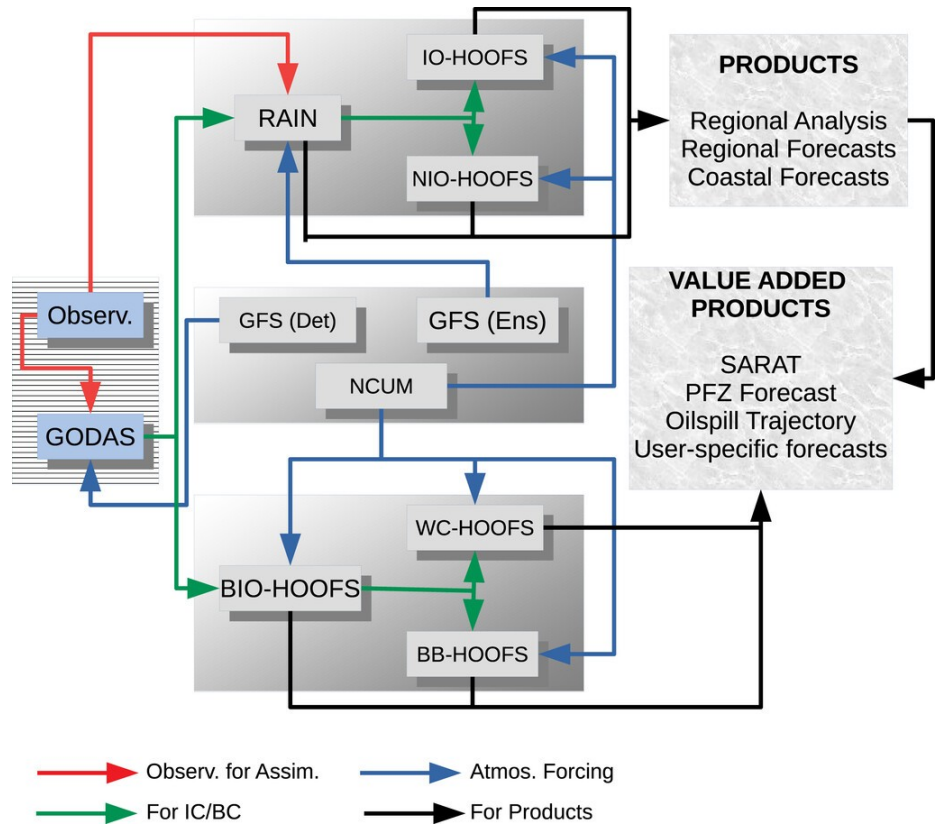
India's forecast system and services journey

INCOIS: Current forecasts, 2018

BAMS
Article

High-Resolution Operational Ocean Forecast and Reanalysis System for the Indian Ocean

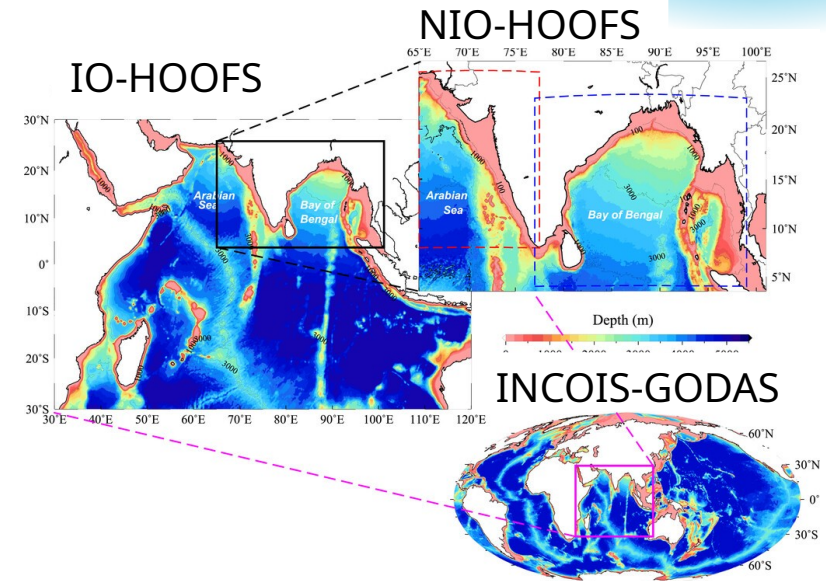
P. A. Francis, A. K. Jithin, J. B. Effy, A. Chatterjee, K. Chakraborty, A. Paul, B. Balaji, S. S. C. Shenoi, P. Biswamoy, A. Mukherjee, P. Singh, B. Deepsankar, S. Siva Reddy, P. N. Vinayachandran, M. S. Girish Kumar, T. V. S. Udaya Bhaskar, M. Ravichandran, A. S. Unnikrishnan, D. Shankar, A. Prakash, S. G. Aparna, R. Harikumar, K. Kaviyazhahu, K. Suprit, R. V. Shesu, N. Kiran Kumar, N. Srinivasa Rao, K. Annapurnaiah, R. Venkatesan, A. S. Rao, E. N. Rajagopal, V. S. Prasad, M. D. Gupta, T. M. Balakrishnan Nair, E. P. R. Rao, and B. V. Satyanarayana



HOOFS:
High resolution Operational Ocean Forecast and reanalysis System

System Improvements:

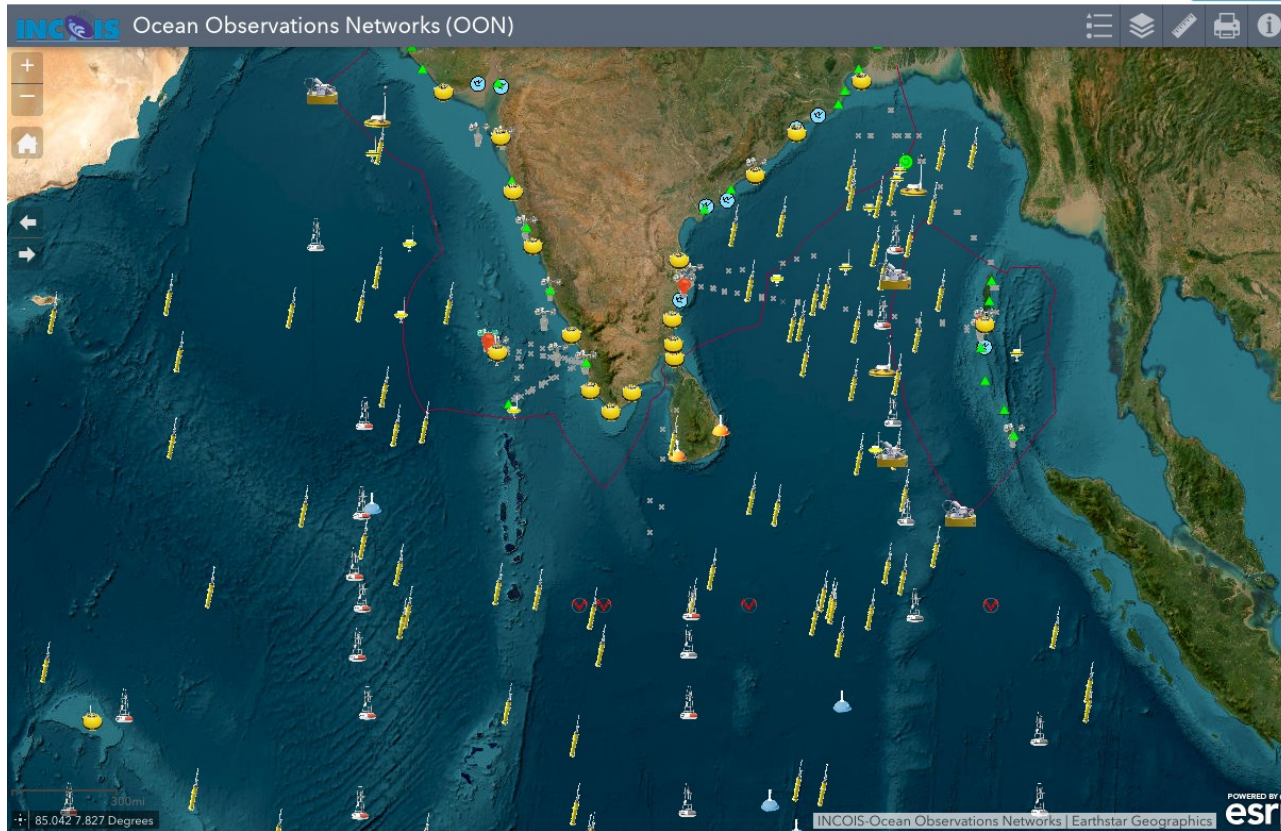
- ◆ Increased resolution (9 km for IO-HOOFs and 2.25 km for NIO-HOOFs)
- ◆ LEKF Data assimilation for IO-HOOFs
- ◆ Inclusion of tides
- ◆ Biogeochemical model



India's forecast system and services journey

INCOIS: Observing Network

OBSERVATIONS!!!!



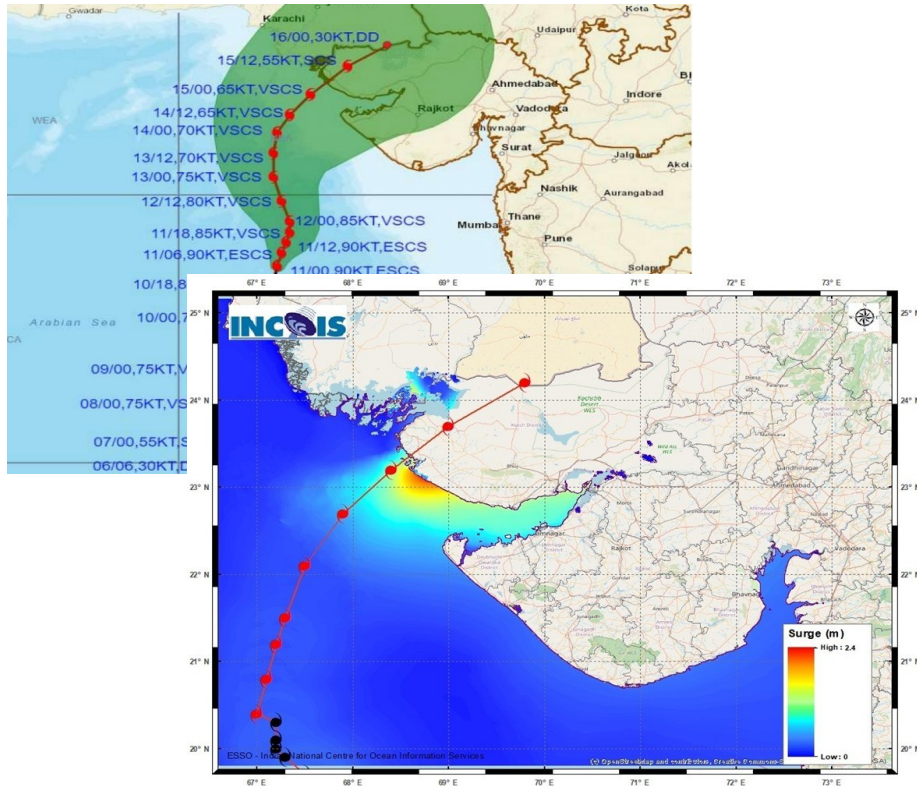
- ◆ Argo
- ◆ Moored Buoys
- ◆ Wave Rider Buoys
- ◆ XBT lines
- ◆ Drifters
- ◆ Wave drifters
- ◆ Ship-mount ADCPs
- ◆ Coastal ADCPs
- ◆ Coastal HF Radars
- ◆ Tide gauges
- ◆ GNSS network

India's forecast system and services journey

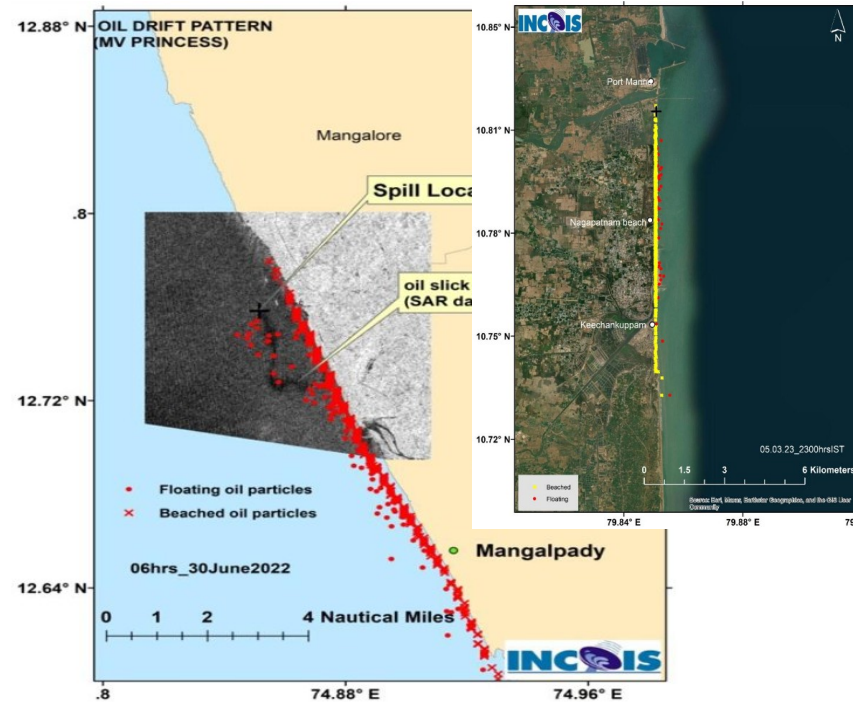
INCOIS: Downstream Applications

Adding value

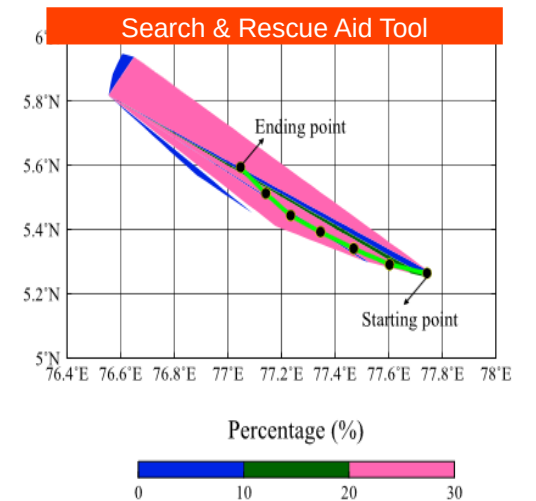
Storm surge prediction (2013)



Oil-spill tracking (2016)



Search & Rescue



India's forecast system and services journey

INCOIS: Downstream Applications and their Dissemination



Effective hazard communication:
both modern and traditional
methods



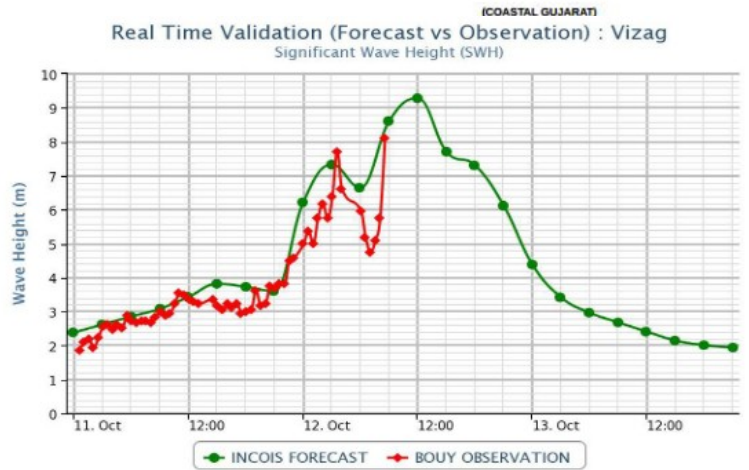
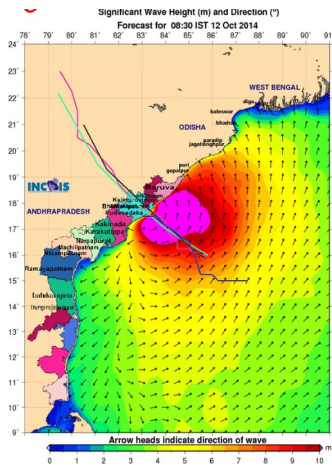
INCOIS
FAX MESSAGE
FROM: ESSO-INDIAN NATIONAL CENTRE FOR OCEAN INFORMATION SERVICES
(Ministry of Earth Sciences, Government of India)
(FAX NO. +91-49-23892910)

To: Senior MET Officer, Western Naval Command, Indian Navy
Commandant, Coast Guard, 9th Region
Pollution Foundation, Mumbai
MSSRF, Chennai
CCMR, Malappuram
Ports in Gujarat & Maharashtra
Chief Secretary, Government of Gujarat
Chief Nautical Officer, Gujarat Maritime Board
Shipping Corporation of India.

Time of issue: 0900 hours IST Dated: 29.10.2014, Bulletin No.: INCOIS/29/10/2014/1

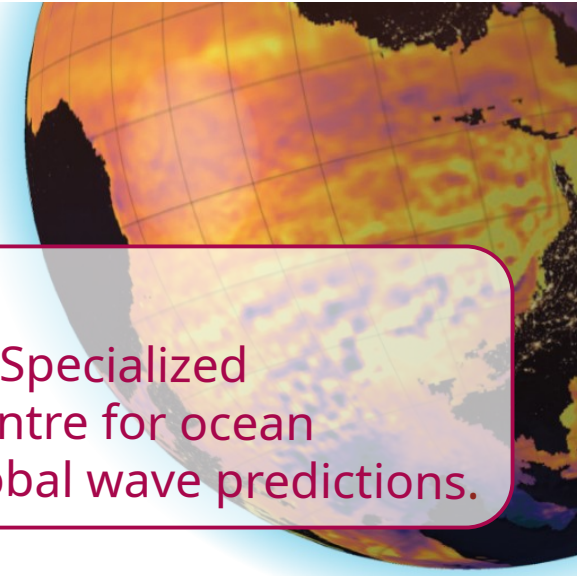
Sub: INCOIS-IMD Joint Bulletin - Ocean State Forecast associated with Very Severe Cyclonic Storm "NILOFAR" over westcentral Arabian Sea.
Cyclone Alert for north Gujarat coast

The very severe cyclonic storm, "NILOFAR" over westcentral Arabian Sea moved nearly northward in past 12 hours, and lay centred at 0530 hours IST of today, the 29th October, 2014 near latitude 18.20 N and longitude 62.00 E, about 900 km southwest of Naliya (Gujarat), 910 km southwest of Karachi (Pakistan) and 420 km southeast of Masrah (Oman). It would move north-northeastwards during next 12 hours and then northeastwards and cross north Gujarat and adjoining Pakistan coast around Naliya by 01st November forenoon. However, as the system would come closer to Gujarat coast, it would weaken and cross the coast as a cyclonic storm.




India's forecast system and services journey


INCOIS: Regional Specialized Meteorological Centre



SUCCESS:
WMO Recognized Specialized Meteorological Centre for ocean circulation and global wave predictions.



**Regional Specialized Meteorological Centre (RSMC)
for Numerical Ocean Wave Prediction
and Global Numerical Ocean Prediction**
Indian National Centre for Ocean Information Services (INCOIS)




The Indian Ocean is a vast stretch of seawater and a source of sustenance and livelihood for millions of people in the countries that border it. The marine resources of the Indian Ocean and the concept of the blue economy play a significant role in supporting the socioeconomic development and well-being of the populations living in this region.

Indian National Centre for Ocean Information Services (INCOIS) is an autonomous organization under the Ministry of Earth Sciences, Government of India. It was established in 1999 and has provided various ocean-related services since then. INCOIS started its wave forecast services from (25-05-2006) and augmented it with essential ocean variables from ocean general circulation models from (03-03-2015). INCOIS generates early warning advisories based on the state of the seas surrounding the Indian subcontinent and serves several island countries. These services are critical for the operational activities of offshore sea goers and onshore activities such as coastal tourism, ports and harbors etc.

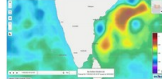
INCOIS operationally runs a suite of wave and ocean general circulation models at different resolutions to provide early warning services to maritime stakeholders. Users of forecasts are equipped to take informed decisions based on the sea state conditions, avoiding loss of life and property. Thus, INCOIS services extensively contribute to the development of the blue economy in the region through its forecasts and advisory services. Forecasts of essential ocean variables at different time scales are thus crucial for a broad spectrum of users ranging from fishermen to offshore industries. Recognizing the role played by INCOIS in issuing forecasts for the region, the WMO Executive Council at its seventy-sixth session (EC-76) adopted the designation of RSMC Indian National Centre for Ocean Information Services (INCOIS) (India) for numerical ocean wave prediction and global numerical ocean prediction.

Waves



[View](#) [Data Download](#)

Ocean Prediction



[View](#) [Data Download](#)

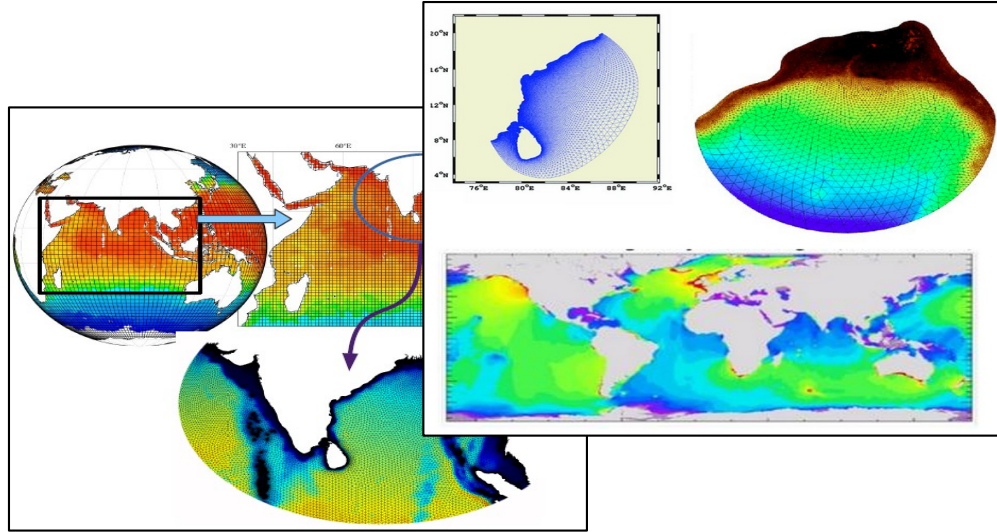
Model Name	Domain	Resolution	Forcing	Mixing	DA	Model Name	Domain	Resolution	Forcing	Mixing	DA
WAVEWATCH-III	Four nested grids covering Global Ocean	Global Ocean (1 x1 deg), Indian Ocean (0.5 x0.5 deg), Northern Indian Ocean (0.25 x0.25 deg) and coastal (10 Km x10 Km)	ECMWF Forecast winds (0.25x0.25deg)	NA	Optimal Interpolation method; Assimilates Sig. Wave Height (SWH) from SARAL/AltiKa, Jason-3, Sentinel-3a and Sentinel-3b and all available in-situ SWH observations in the Indian Ocean	Hybrid Coordinate Ocean Model (HYCOM) version-2.35	20E-120E & 43S-30N	6.9 km (1/16) degree nested to a 25 km (1/4) Global Hycom	Atmospheric forcing: GFS Rivers; NRL climatology	KPP mixing	Method: Tendral Statistical Interpolation (Reduced Order Kalman Filter) Variables: AVHRR-SST, + L2 & L3 Along Track altimeter data. Argo profiles of Temperature & Salinity

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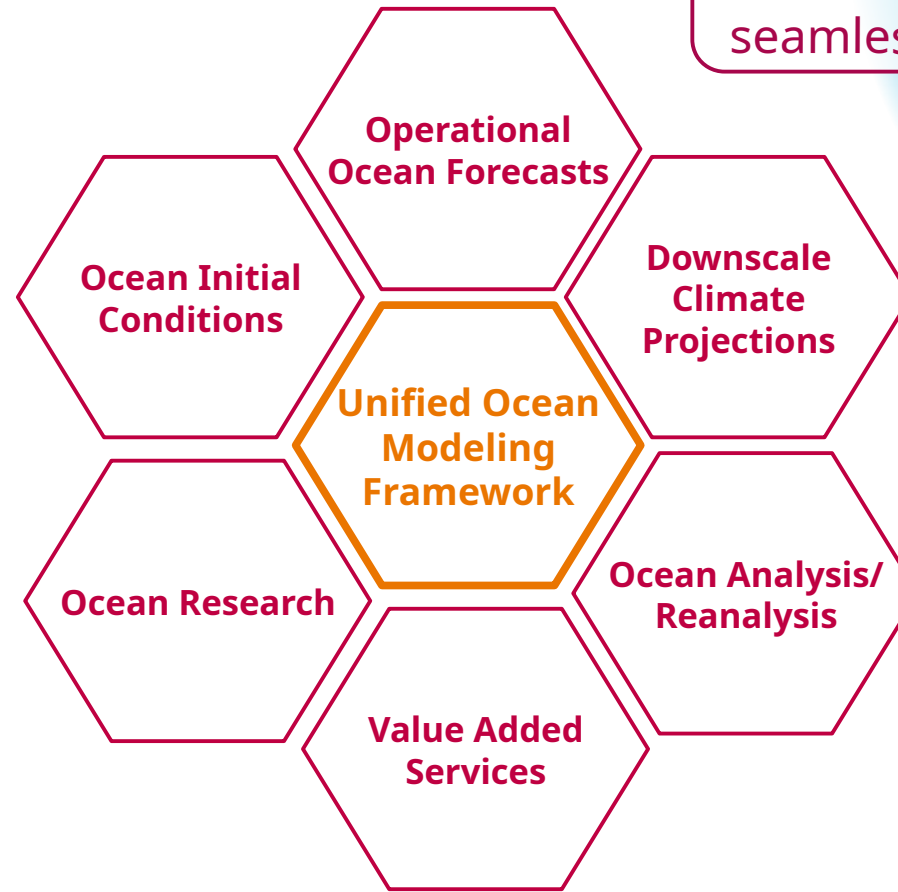
India's forecast system and services journey

INCOIS's next chapter



Under development:

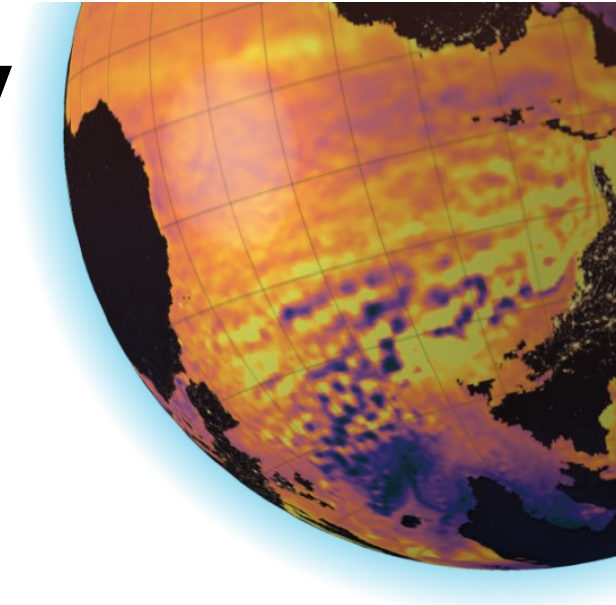
- ◆ ROMS system to be replaced by MOM
- ◆ Coastal predictions with FVCOM systems.

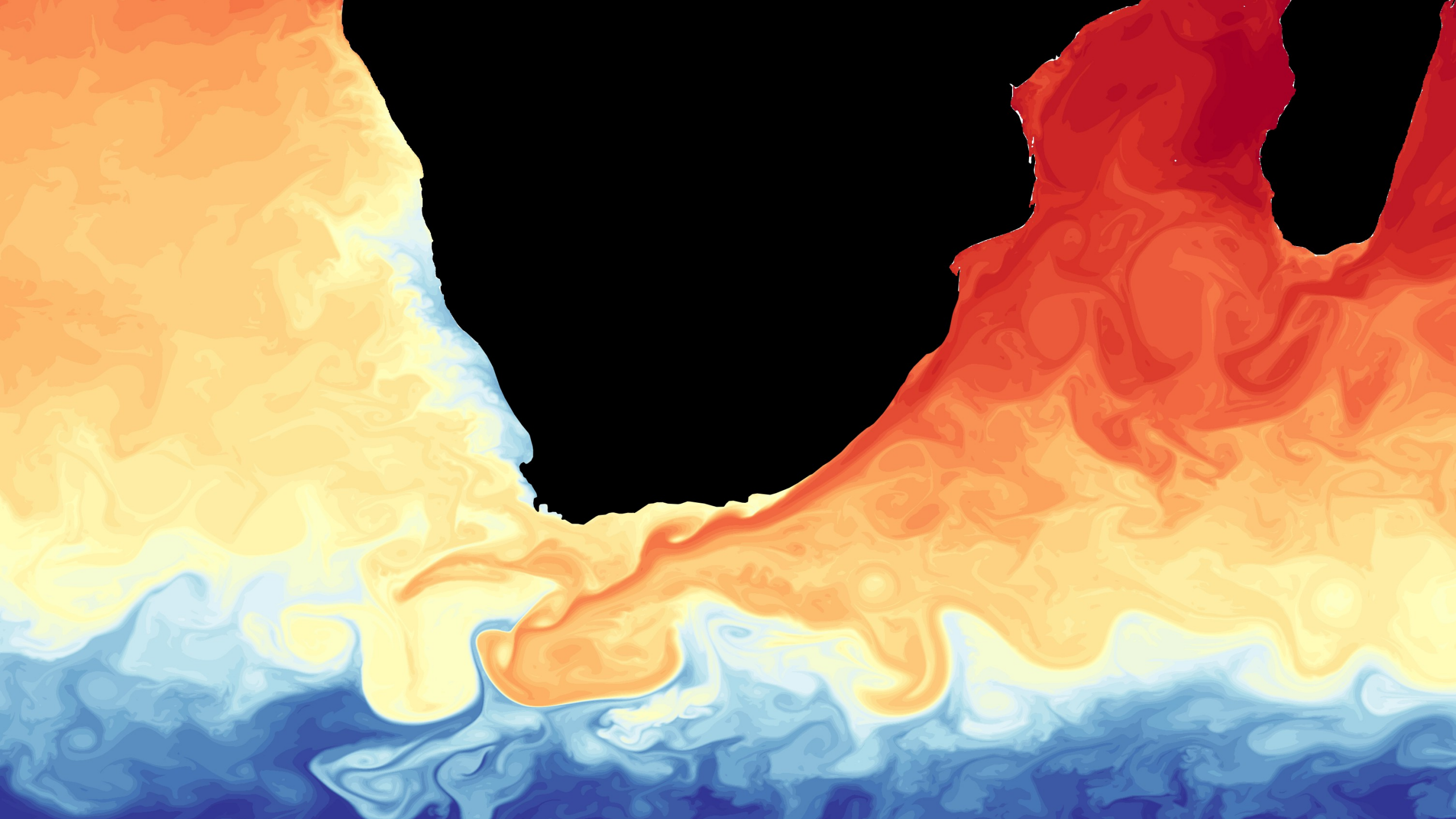


UPGRADES:
To make the system more seamless

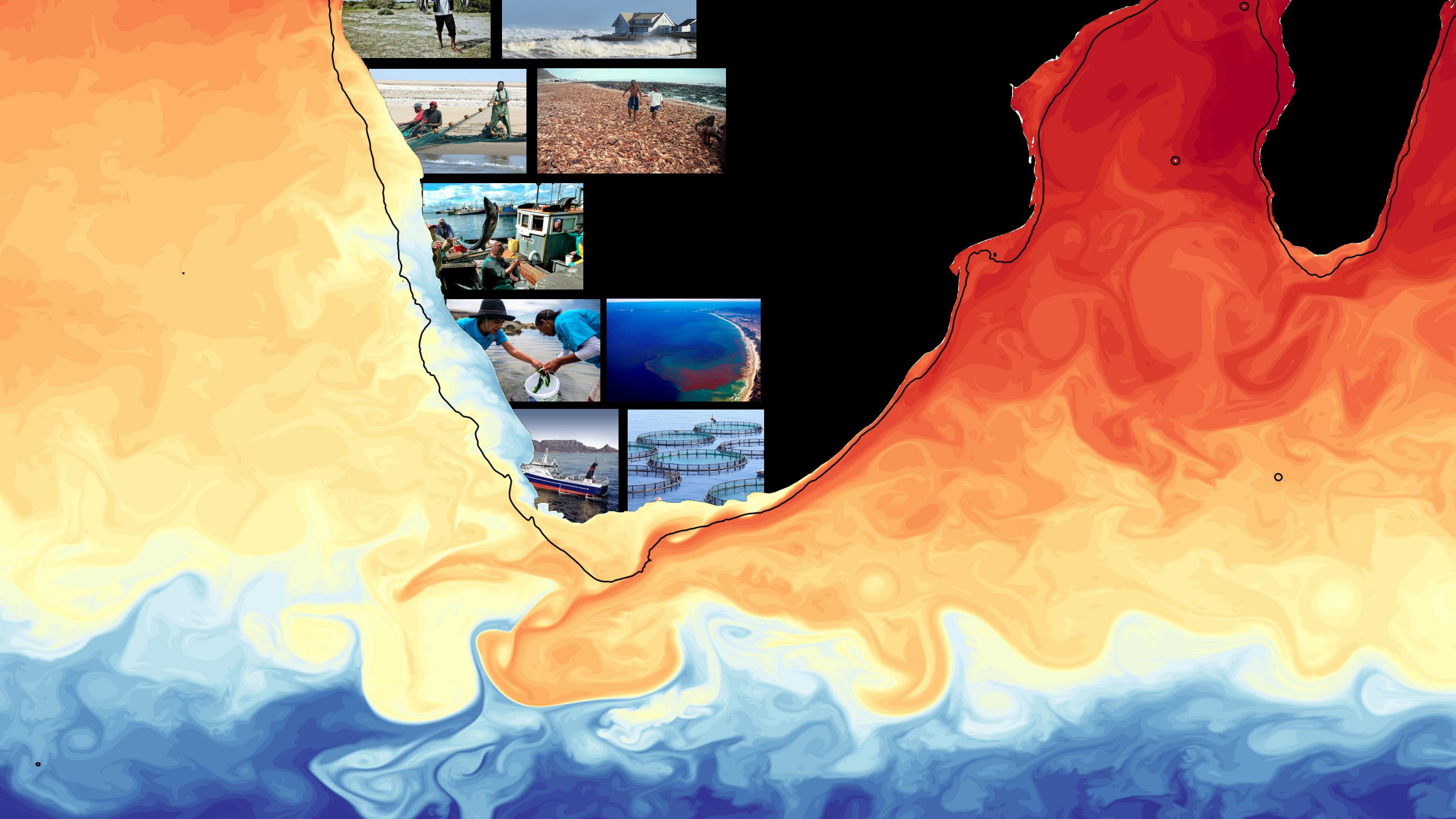
- ◆ MOM6
- ◆ FVCOM
- ◆ Wavewatch III
- ◆ ADCIRC

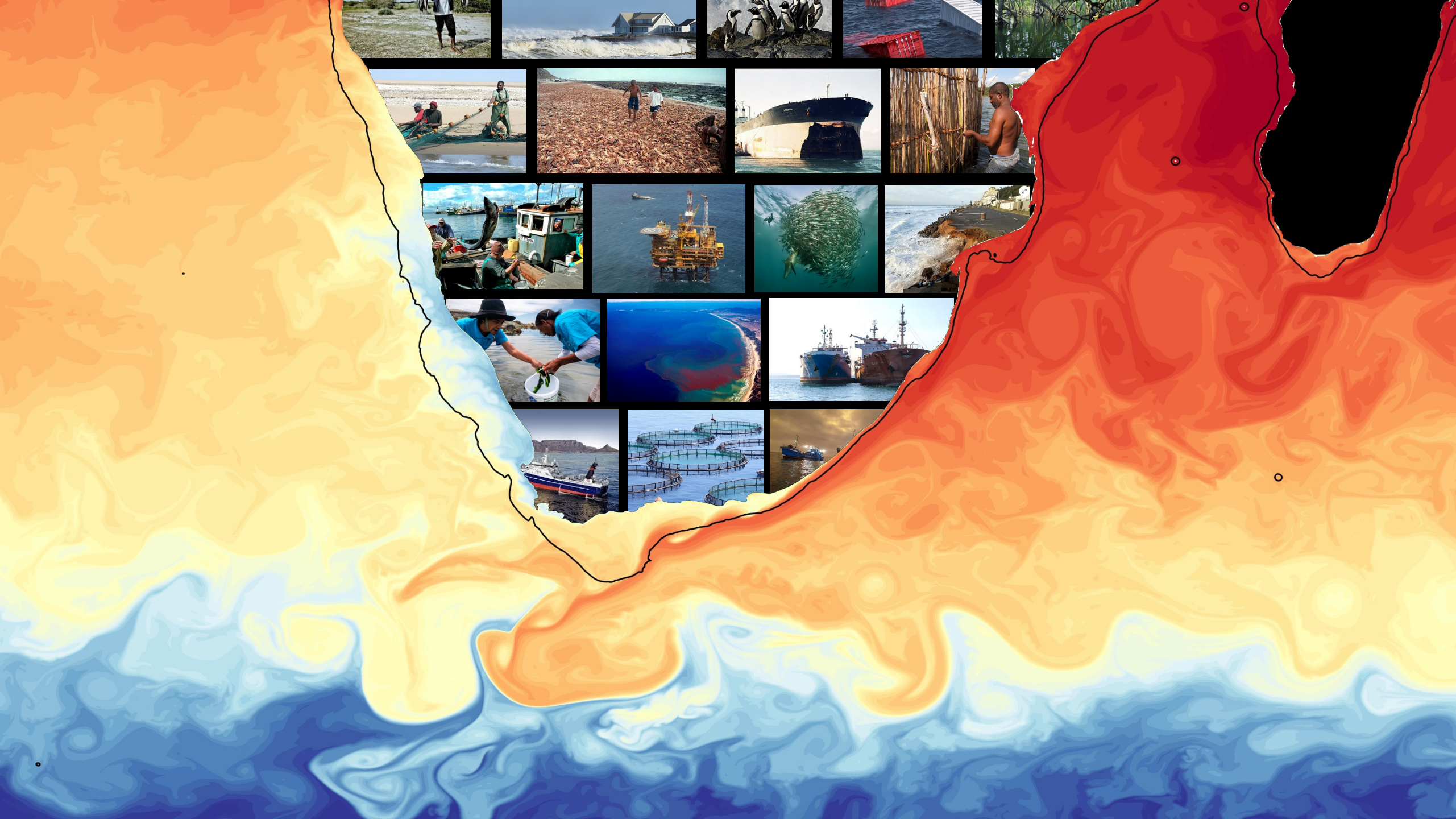
South Africa's forecast system and services journey









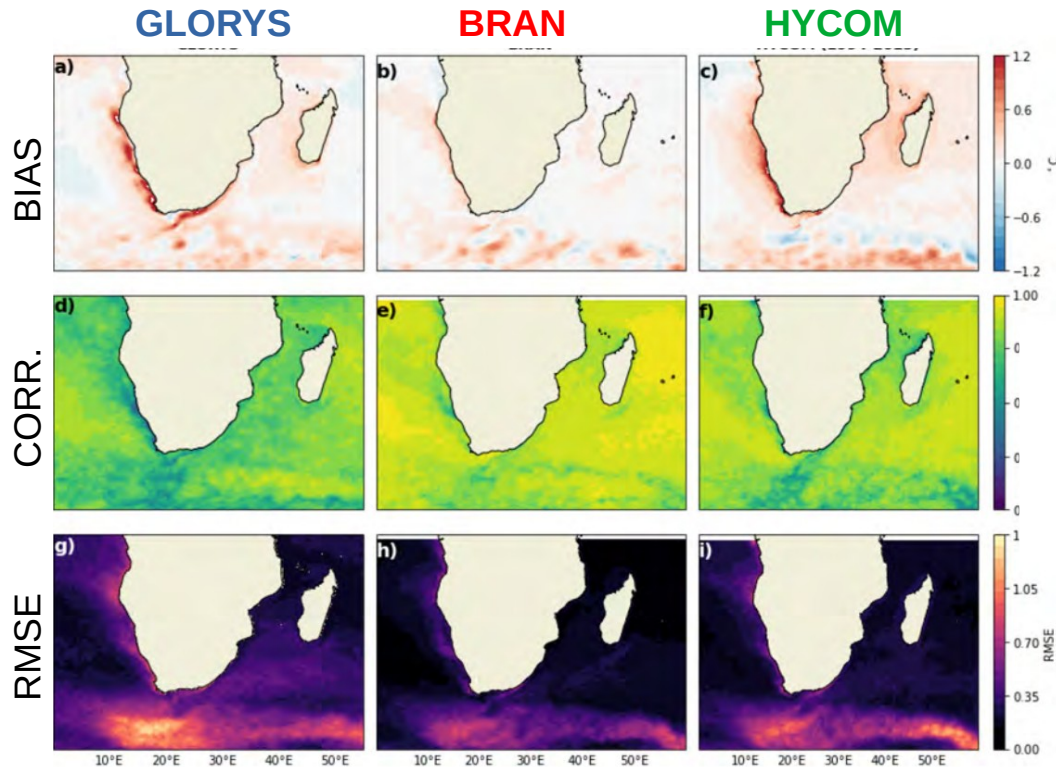


South Africa's forecast system and services journey

Global Reanalysis Systems

Opportunity: Locally optimized systems are needed.

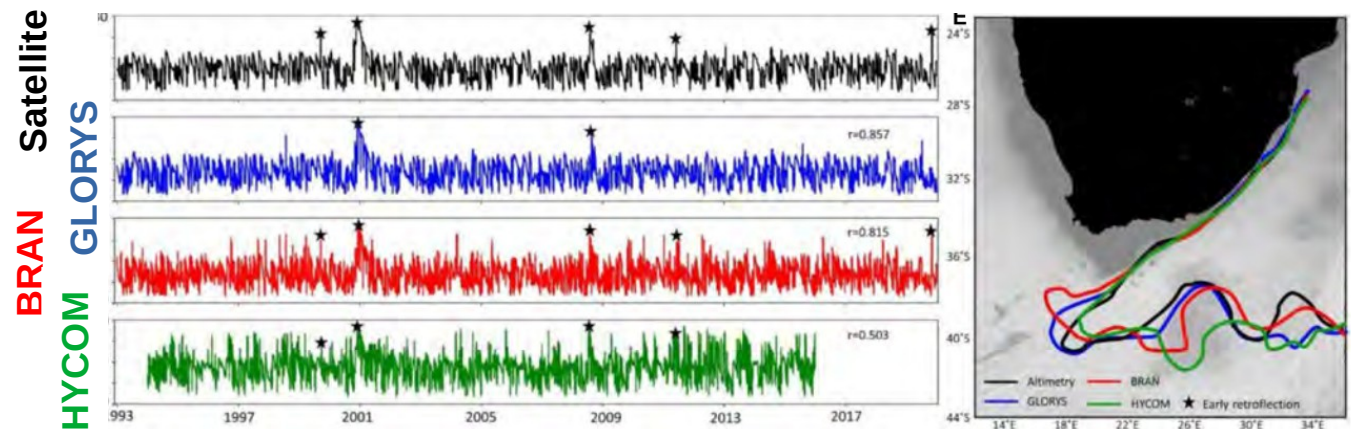
Sea Surface Temperature (vs OSTIA)



Pressure Points

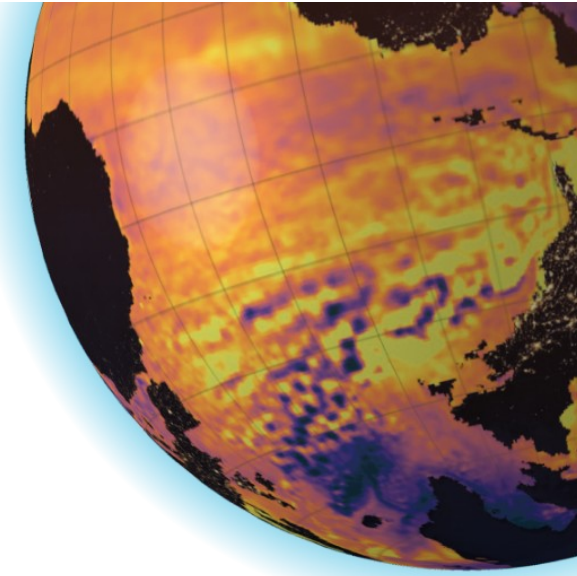
- ◆ The Benguela upwelling system
- ◆ Intense frontal features
- ◆ The Agulhas retroflection and associated leakage

Longitudinal position of retroflection (★ = early)



South Africa's forecast system and services journey

Once upon a time ..



2010

SimOcean
Simulating and forecasting southern Africa's ocean

Home | About Us | Team | News | Research Activities | Ocean Models | Operational Initiative | Contact Us

SimOcean is a multi-institutional initiative to develop ocean modelling and forecasting capacity in southern Africa. The modelling platform supports ocean research and operational activities, providing an arena in which modelling expertise, model output, and forecasts are shared.

Strategic Partners:
UNIVERSITY OF CAPE TOWN
UNIVERSITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD
CSIR
ACCESS
NERSO

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South Africa's forecast system and services journey

Once upon a time ..

2010

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2014



OPERATION PHAKISA | OCEANS ECONOMY

What is Operation Phakisa?

Why Oceans Economy matters:

Why the Oceans Economy matters:
South Africa has a coastline of 3 900 km including the sub-antarctic island... The Aquaculture sector has the potential to grow sector revenue to... are real... are greatly... he benefit... ct at least... Areas... d fuel are... ousities... economic... y building... of Marine... Gas and...
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 9000 Website: www.operationphakisa.gov.za or www.environment.gov.za Email us: oceansphakisa@environment.gov.za

Catalyst: High level recognition of the need for a sustainable Oceans Economy.

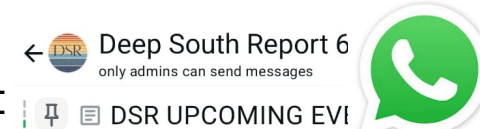
Six work streams:

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



South Africa's forecast system and services journey

South African Weather Service (SAWS) Marine Portal

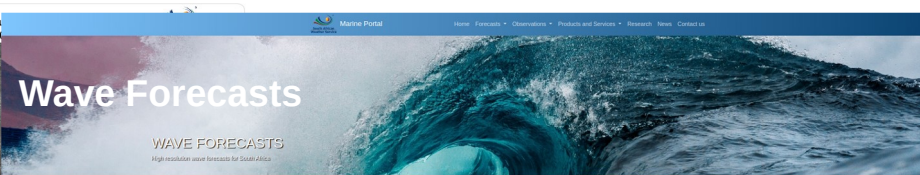
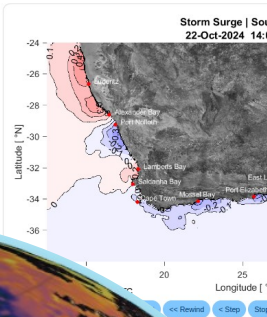


Storm surge is a particularly damaging phenomenon caused by a combination of strong onshore winds and low atmospheric pressure. This results in abnormal volumes of water accumulating against the coastline, manifesting as a raised sea level which can last for several hours. Storm surges are major drivers of coastal flooding. They should not be confused with large ocean swells, which may look impressive when they crash against the coastline, but do not necessarily cause flooding!

These data are produced in-house by the SAWS storm surge forecasting system. A regional, depth-averaged ocean model has been employed, with a 1 minute computational time step. SAWS forecasters use this tool to consult regularly with Disaster Risk Management to ensure sufficient forecasting for storm surge events. The map provides a regional overview, whilst the time series plots below provide detail for specific areas of interest. The Marine Unit constantly monitors the performance of the wave model using observed data.

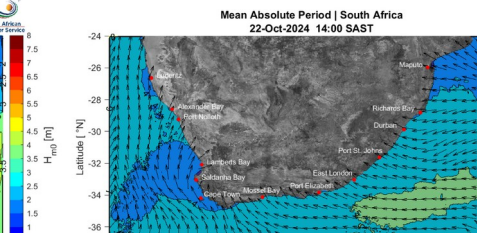
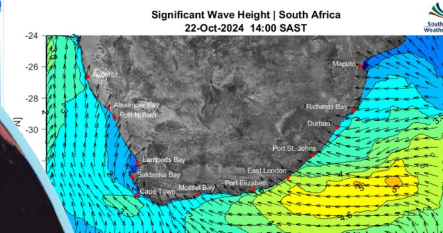
◆ **Public Good Services:** funded by the government and delivered to the public free of charge. These include general forecasts, severe weather warnings and advisories, seasonal outlooks for farmers

◆ **Commercial Services:** primarily aviation and ports



Monitoring and predicting ocean waves is a primary activity within the SAWS Marine Unit. Waves have an impact on every aspect of ocean and coastal safety and ecology, and have a particularly important impact on marine safety. These data are produced in-house by the high resolution SAWS wave forecasting system. A nested modelling approach has been followed, where a local numerical grid has been nested, online, in the non-stationary regional spectral wave model. The map provides a regional overview ($T_{m0.1}$ approximately 4 hrs), whilst the high resolution forecast maps ($T_{m0.1}$ approximately 2 hrs) and the series plots below provide detail for specific areas of interest. The Marine Unit constantly monitors the performance of the wave model using observed data.

These regional and high resolution (zoomed in) maps show the Mean Absolute Wave Period ($T_{m0.1}$). Wave period is an intrinsic property of a wave and will not readily change through shoaling/retardation water wave transformation. The $T_{m0.1}$ is used conventionally as an added parameter to better represent a user's experience of the local sea state. It gives a useful idea of the average period of all the waves, rather than that of only the highest energy waves (peak periods) in the area of the local beach (which is typically shown on wave warning graphics). See the following publication for more details: Waves in Oceanic and Coastal Waters - Leo Huisman



YELLOW LEVEL 2 WARNING

WEATHER TYPE
WIND AND WAVES

WARNING KEY

1	2	3	4	5
Low	Low	Low	Low	Low
Low	Low	Low	Low	Low
Low	Low	Low	Low	Low

AFFECTED AREA: WESTERN CAPE

DISCUSSION
Valid from 18/09/2024 at 12:00 SAST until 19/06/2024 at 24:00 SAST
Strong to near-gale force north-westerly to westerly winds (50-70 km/h), gusting 70-90 km/h) are expected between Cape Columbine and Plettenberg Bay from Wednesday afternoon, while reaching gale force between Gansbaai and Plettenberg Bay until the evening. The winds will turn south to south-westerly during the course of Wednesday. Additionally south to south-westerly swells with wave heights of 4.0 to 5.0 m are possible, while reaching 6.0 m between Cape Point and Plettenberg Bay from Wednesday evening into Thursday morning. Spring tide is also expected on Wednesday afternoon.

IMPACTS

- Difficulty in navigation at sea is likely.
- Small vessels and personal watercraft (e.g. kayaks) may be at risk of taking on water and capsizing in a locality.
- Localised disruptions to small harbours and ports is expected.
- Localised disruption to beachfront activities as well as coastal users being swept off rocks are possible.

Celestine

YELLOW LEVEL 1 WARNING

WEATHER TYPE
WAVES AND WIND

WARNING KEY

1	2	3	4	5
Low	Low	Low	Low	Low
Low	Low	Low	Low	Low
Low	Low	Low	Low	Low

AFFECTED AREA: WESTERN CAPE

DISCUSSION
The south African high pressure system will result in strong to near-gale force (50-61 km/h) westerly winds between Cape Point and Cape Agulhas from tonight, spreading to Plettenberg Bay on Thursday evening persisting until Friday morning (05:00-02:00).

IMPACTS

- Danger to navigation at sea for small vessels and personal watercraft (e.g. kayaks) is likely.
- Small vessels and personal watercraft may be at risk of taking on water and capsizing in a locality.
- Localised disruption to small harbours and ports and beachfront activities may also be possible as well as coastal users (e.g. rock anglers) are at risk of being swept off rocks and swept off the beach.

Celestine

IMPACT BASED WARNING issue: 08:59 on Wed 06 Nov 2024

LEVEL 1 for Damaging Waves
WARNING issued Wed 06 Nov 20:20 until Fri 08 Nov 00:00

Affected DM / LM / Metro area
M. Bissa, M. Cape Agulhas, M. Cape Agulhas, M. City of Cape town, M. George, M. Hottentots, M. Kysna, M. Mossel Bay, M. Simon's Bay

Short Message
Is expected along the coast between Cape Point and Cape Agulhas from tonight, spreading to Plettenberg Bay on Thursday evening persisting until Friday morning (05:00-02:00).

Discussion
The south African high pressure system will result in strong to near gale force (50-61 km/h) westerly to south-easterly winds between Cape Point and Cape Agulhas from tonight. Coupled with the swells, significant south-westerly waves with heights of 4.0 to 5.0 m are expected. These conditions will be spreading along the south coast to Plettenberg Bay during Thursday evening and persisting until Friday morning (05:00-02:00).

Impacts
Danger to navigation at sea for small vessels and personal watercraft (e.g. kayaks) are possible near the risk of taking on water and capsizing in a locality. Disruptions to small harbours...

C.Ramjukadh: Co-development of operational rip hazard forecasts for the Cape Peninsula of South Africa
On Thursday 21 November, Session 7.2

Success: Simple, yet effective end-user communication.

South Africa's forecast system and services journey

Oceans & Coastal Information Management System (OCIMS)



- ◆ **Improve ocean protection and management** and promote the development of an environmentally conscious ocean economy through the **sharing of knowledge and data across** the public and private sectors
- ◆ **Encourage** cross-government **collaborations**, communities of practices and partnerships.
- ◆ Develop a **fit for purpose operational system** through continued consultations between developers and stakeholders.
- ◆ Remain **locally relevant** and **globally cognizant**.



Strength:
Consortium-Approach



In partnership with



South Africa's forecast system and services journey

Oceans & Coastal Information Management System (OCIMS)



National Oceans and Coastal Information Management System

Coastal Viewer

Fisheries & Aquaculture Support

Marine Spatial Planning

Coastal Flood Hazard

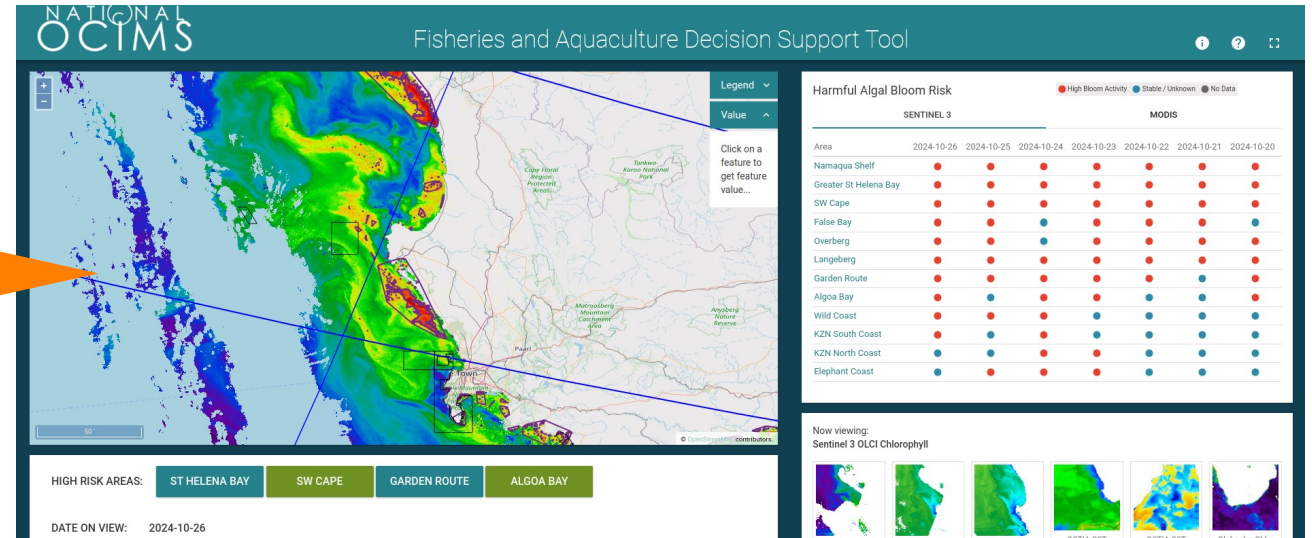
Water Quality

Marine Predators

Coastal Operations at Sea

Integrated Vessel Tracking

Marine Information Management System (MIMS)



Success:
End-user co-designed tools

J.Veitch: The South African National Oceans and Coastal Information Management System's co-designed path from data production to actionable insights
On Monday **18 November, Session 6.2**



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

Strength:
Consortium-Approach

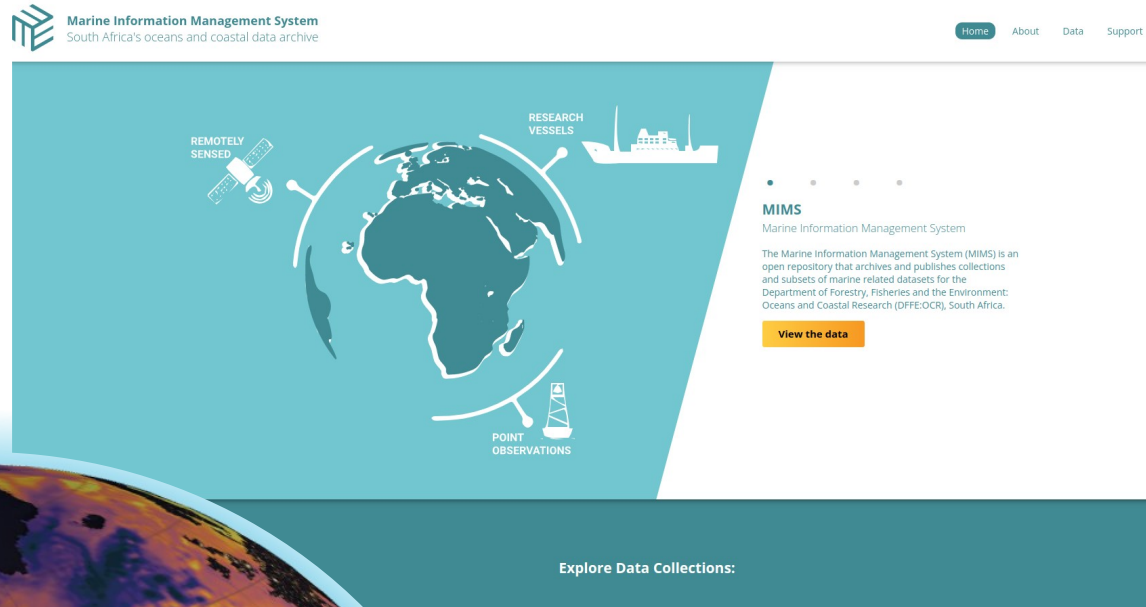


In partnership with



South Africa's forecast system and services journey

Marine Information Management System (MIMS)



- ◆ Following FAIR principles, MIMS is an **open repository** tasked with the long-term preservation of South Africa's ocean and coastal data
- ◆ An **accredited data unit of the IOC** and is the AfroBIS Node for sub-saharan Africa.
- ◆ Adheres to **best data management practices** and is designed with a inter-operability in mind



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

Opportunity: Open data repository is in place to support systems and services



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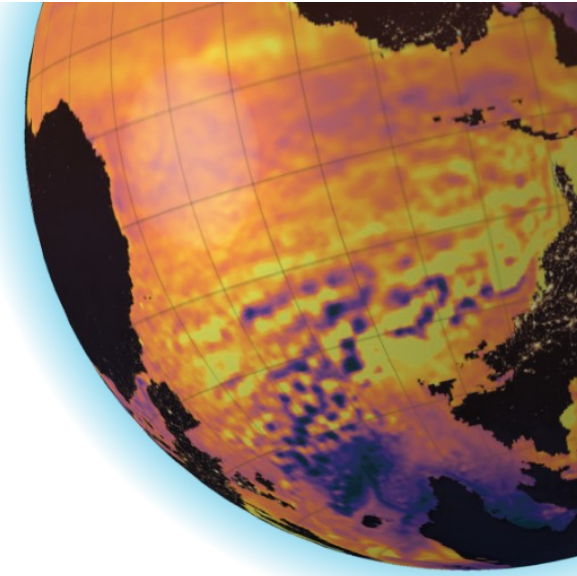
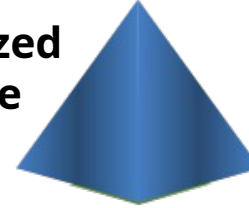


South Africa's forecast system and services journey

SOMISANA:

A Sustainable Ocean Modelling Initiative, A South African Approach

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**



science & innovation

Department:
Science and Innovation
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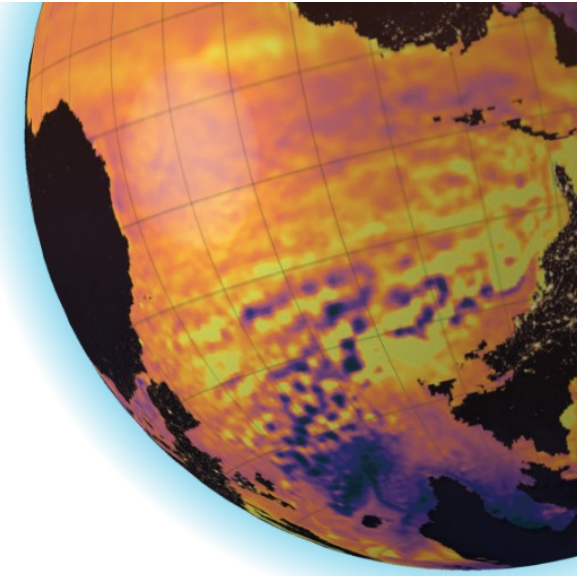
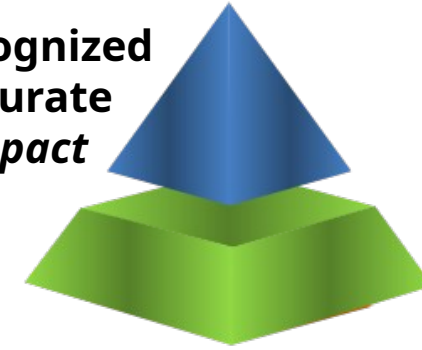
South Africa's forecast system and services journey

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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**



SAEON
South African Environment
Observation Network



science & innovation

Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA



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2021 United Nations Decade
of Ocean Science
2030 for Sustainable Development

South Africa's forecast system and services journey

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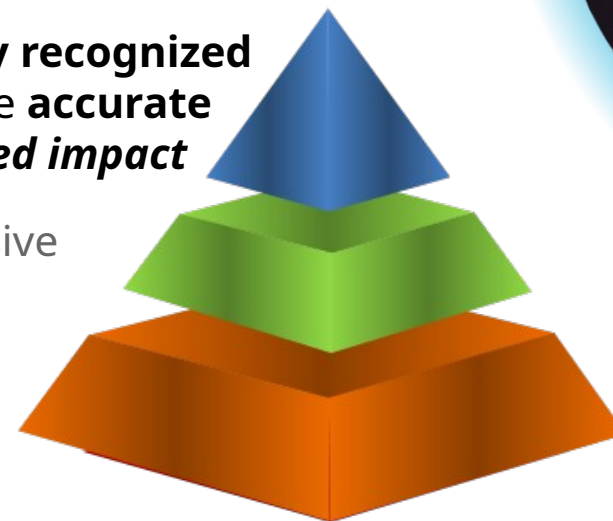
MISSION An ocean modelling hub and platform that promotes the inclusive development of local expertise and that produces and provides state-of-the-art ocean information, tools and research that is **visible and accessible to all**

GOALS 1. Model Development

- ◆ Limited domain OFSs
- ◆ Optimized hindcast/reanalysis

2. Capacity Development

NATIONAL
OCIMS



science & innovation

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2021
2030 United Nations Decade
of Ocean Science
for Sustainable Development

South Africa's forecast system and services journey

SOMISANA:

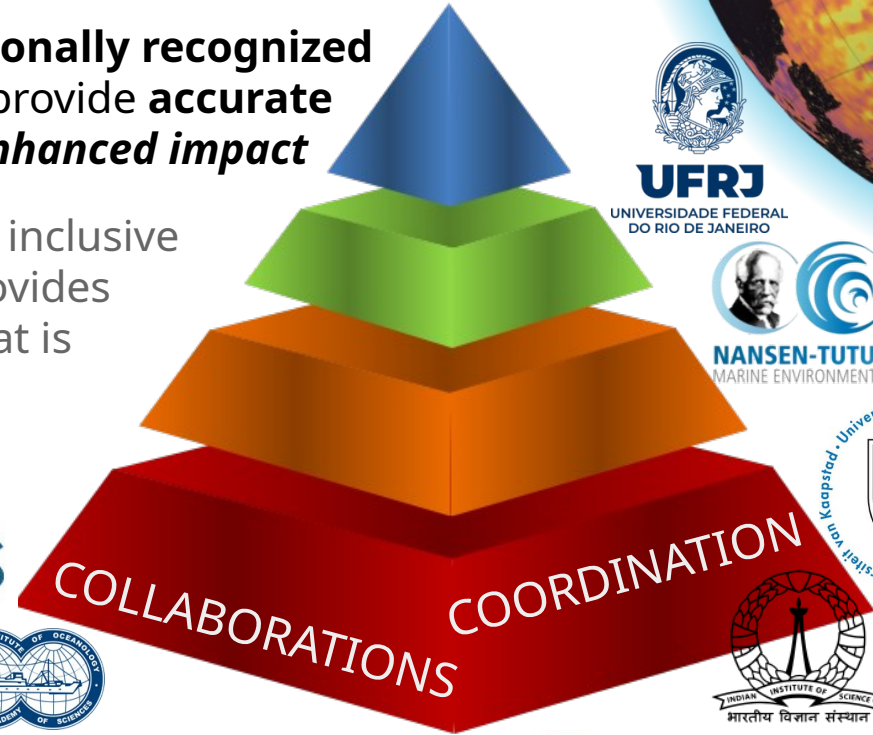
A Sustainable Ocean Modelling Initiative, A South African Approach

SOMISANA:
'to work together'

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**

- GOALS**
- 1. Model Development**
 - ◆ Limited domain OFSS
 - ◆ Optimized hindcast/reanalysis
 - 2. Capacity Development**



NATIONAL OCIMS



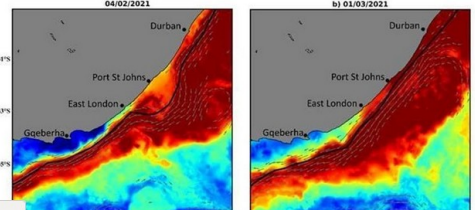
South Africa's forecast system and services journey

SOMISANA: Operational Products The low-hanging fruit

Lesson:
Simple can be impactful

✦ **Adding value** to freely available forecast systems* and satellite products

08 Mar
Ocean temperature change causes wash-up of fish now toxic for eating
news24 Jenni Evans



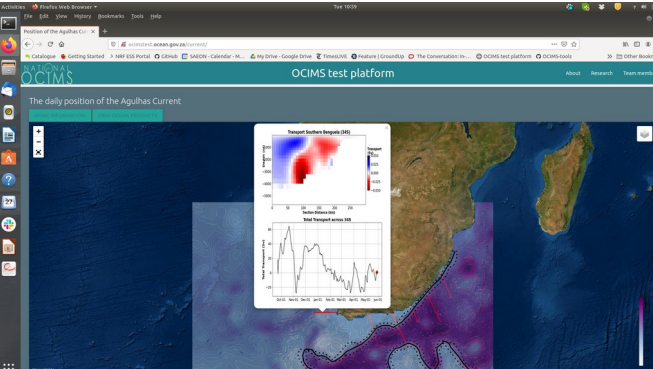
04/02/2021
Durban
Port St Johns
East London
Goeberha

01/03/2021
Durban
Port St Johns
East London
Goeberha



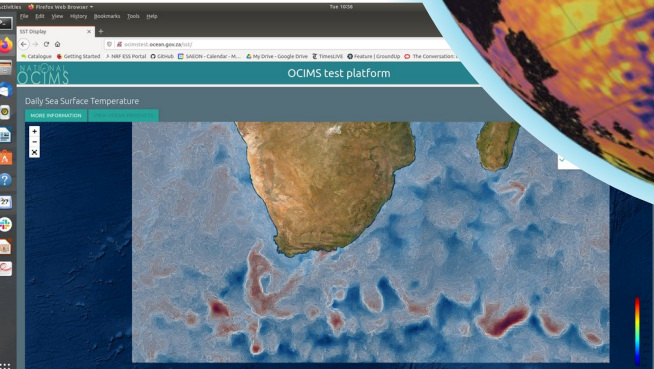
OCIMS test platform

The daily position of the Agulhas Current




OCIMS test platform

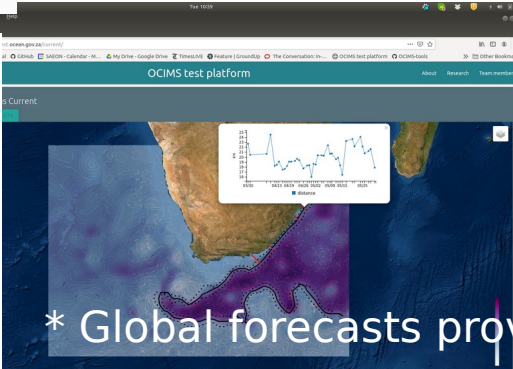
Daily Sea Surface Temperature



MERCURY NEWS
Endurance athlete Sarah Ferguson starts 1 500km swim from Durban to Cape Town

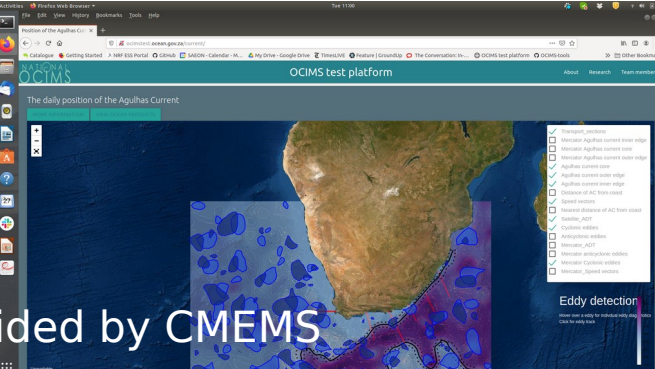


OCIMS test platform



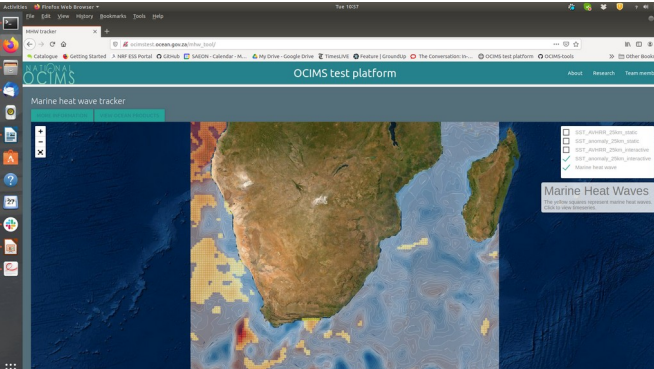
OCIMS test platform

The daily position of the Agulhas Current



OCIMS test platform

Marine heat wave tracker



* Global forecasts provided by CMEMS

South Africa's forecast system and services journey

SOMISANA: Operational Forecast Systems

Downscaling Approach

Enabler: Reliable, accessible, quality global forecast products

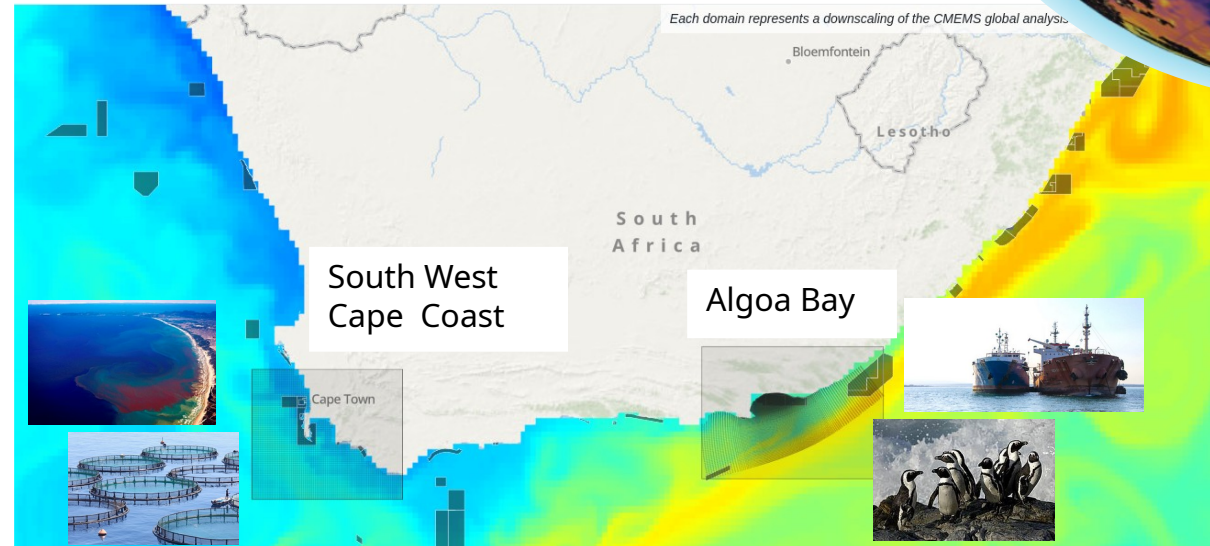
- ◆ Limited area, **downscaled** forecasts of high-use, well-monitored and sensitive regions.
- ◆ Forced with **freely available** global ocean (CMEMS) and atmospheric (GFS) forecasts. 🙏
- ◆ **NO assimilation**
- ◆ Provide high resolution (~500m - 3 km), **5-day forecasts**

G. Fearon: A relocatable approach to regional ocean forecast systems: applications along South Africa's continental shelf

On **Wednesday 20 November, Session 2.2**

Sustainable Ocean Modelling Initiative: A South African Approach

HIGH-RESOLUTION SOUTH AFRICAN EEZ OCEAN DATA



SAEON Shallow Marine Coastal Research Infrastructure (SMCRI) Long term Observing Network: Algoa Bay and SWCC region as 'Sentinel Sites'

South Africa's forecast system and services journey

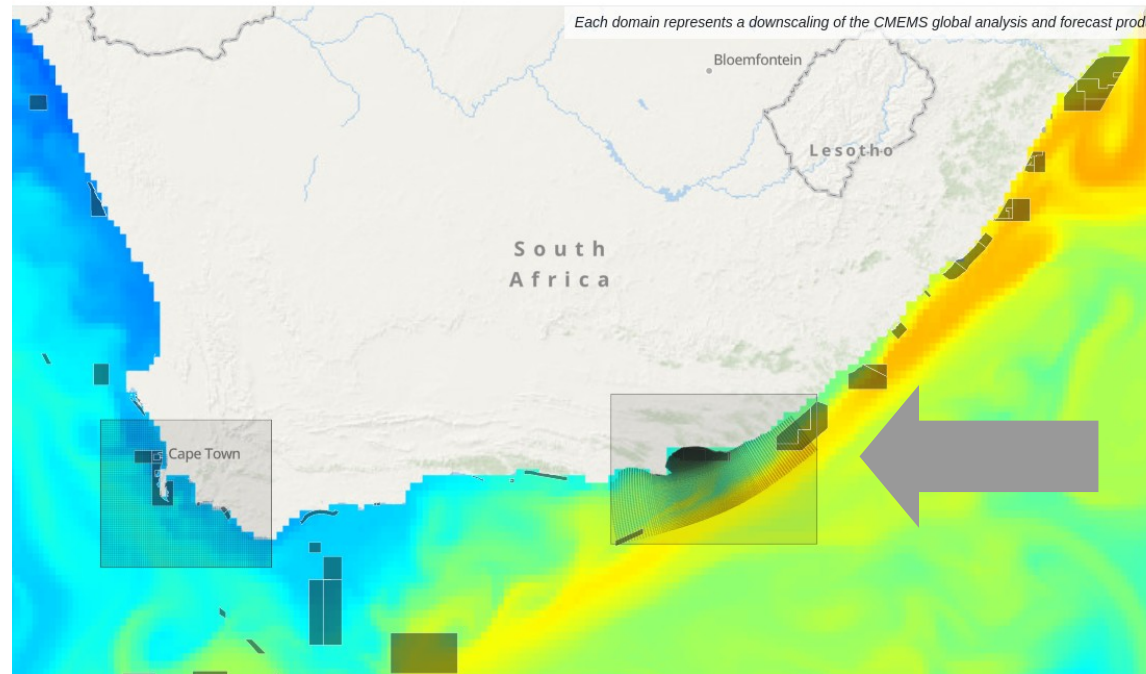
SOMISANA: Operational Forecast Systems

Downscaling Approach

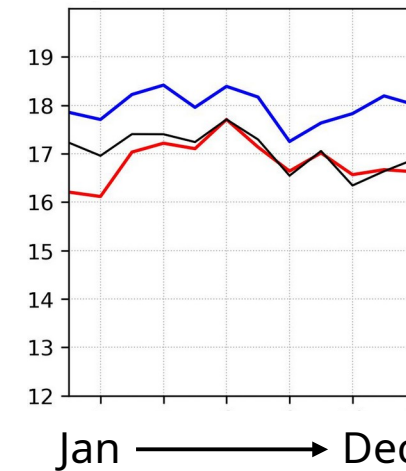
Lesson:
Simple can be good

Sustainable Ocean Modelling Initiative: A South African Approach

HIGH-RESOLUTION SOUTH AFRICAN EEZ OCEAN DATA



10m temperature



Global Reanalysis

In Situ
Downscaled
system

South Africa's forecast system and services journey

SOMISANA: Operational Forecast Systems

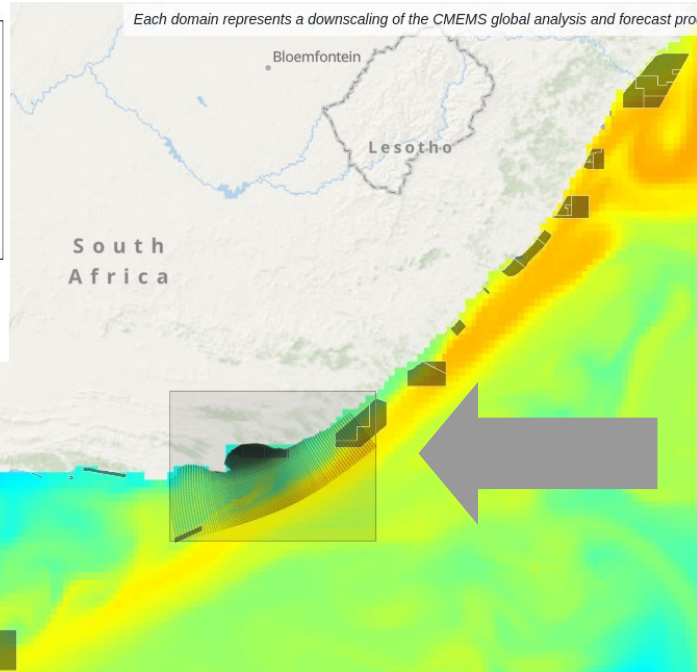
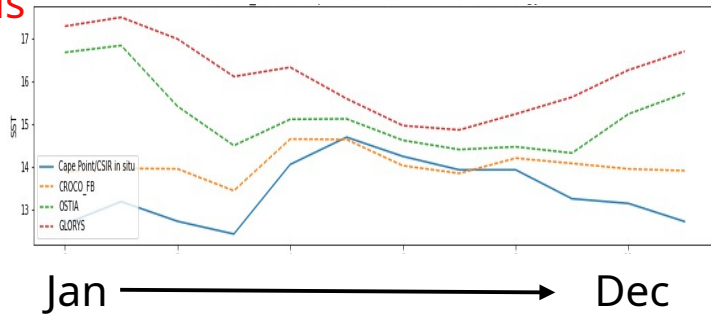
Downscaling Approach

Lesson:
Simple can be good

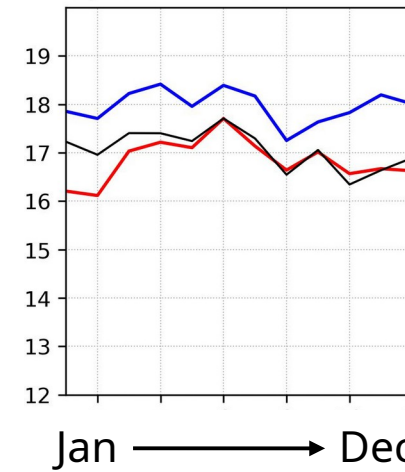
Sustainable Ocean Modelling Initiative: A South African Approach

Sea Surface Temperature

1/4-H-RESOLUTION SOUTH AFRICAN EEZ OCEAN DATA



10m temperature



Global Reanalysis

In Situ
Downscaled system

Global Reanalysis

Satellite

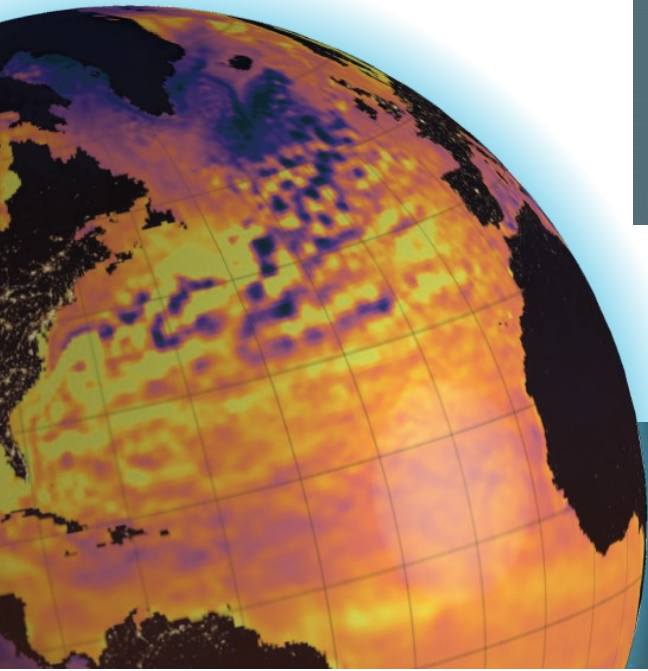
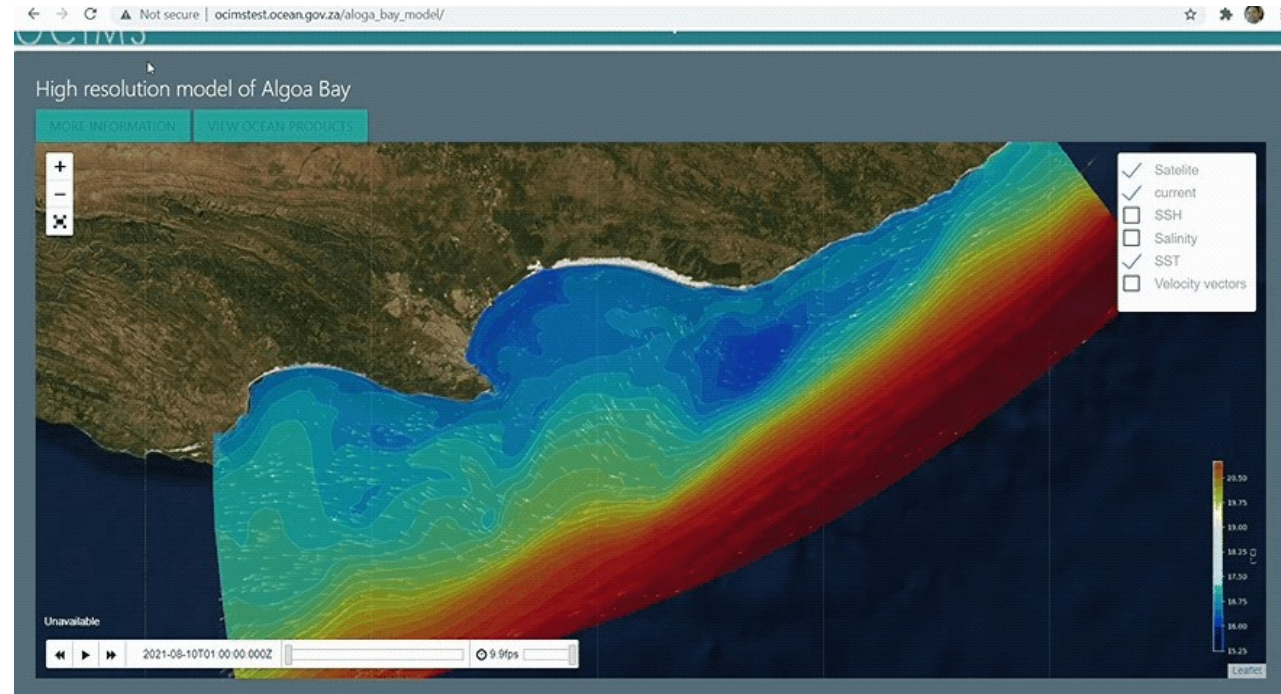
Downscaled System

In situ

South Africa's forecast system and services journey

SOMISANA: Operational Forecast Systems

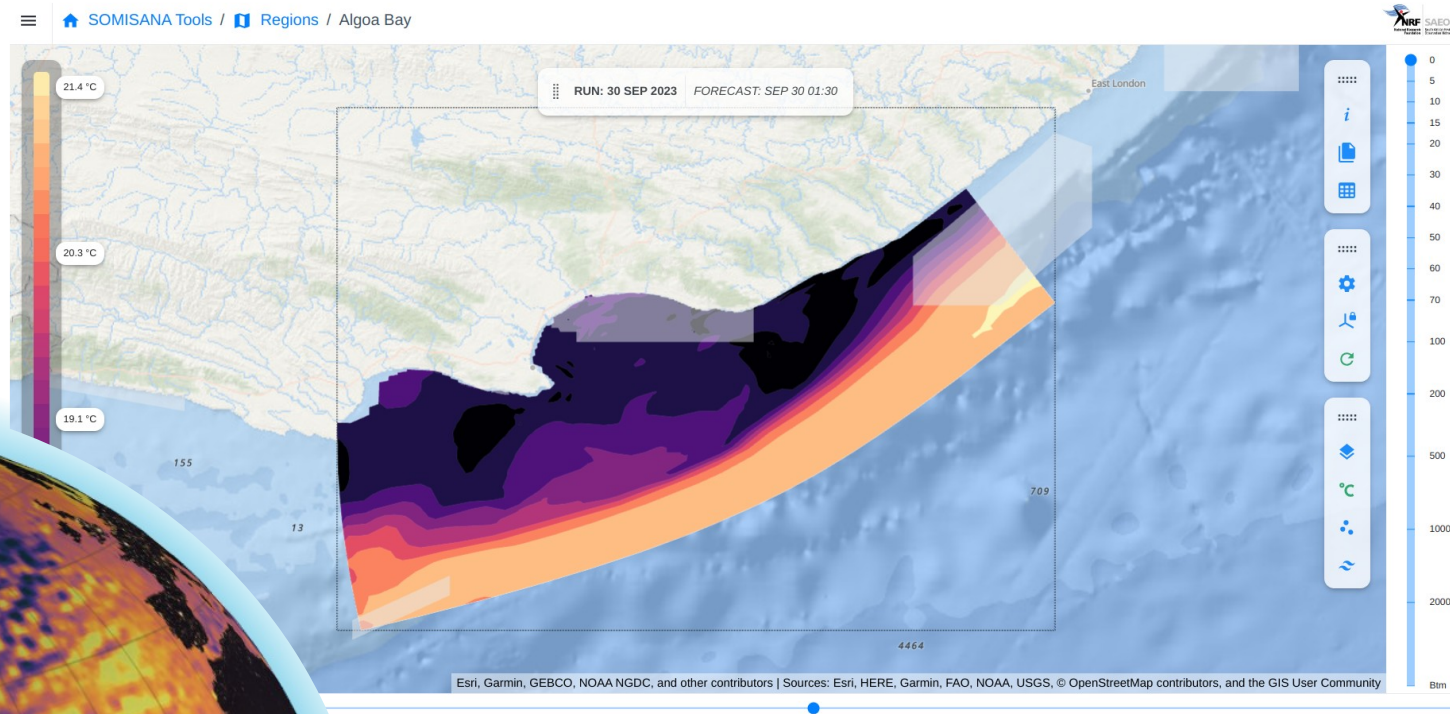
Visualization Portal, first iteration



South Africa's forecast system and services journey

SOMISANA: Operational Forecast Systems

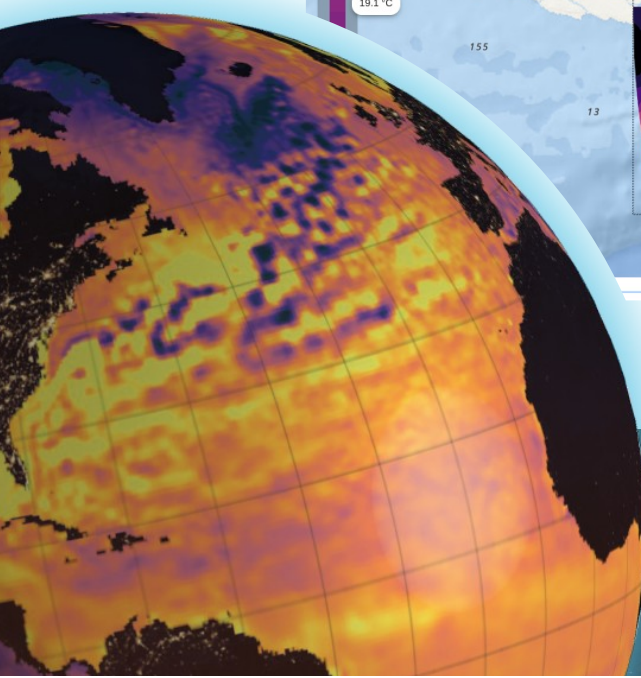
Visualization Portal, second iteration



Portal allows users to:

- ◆ zoom in and out

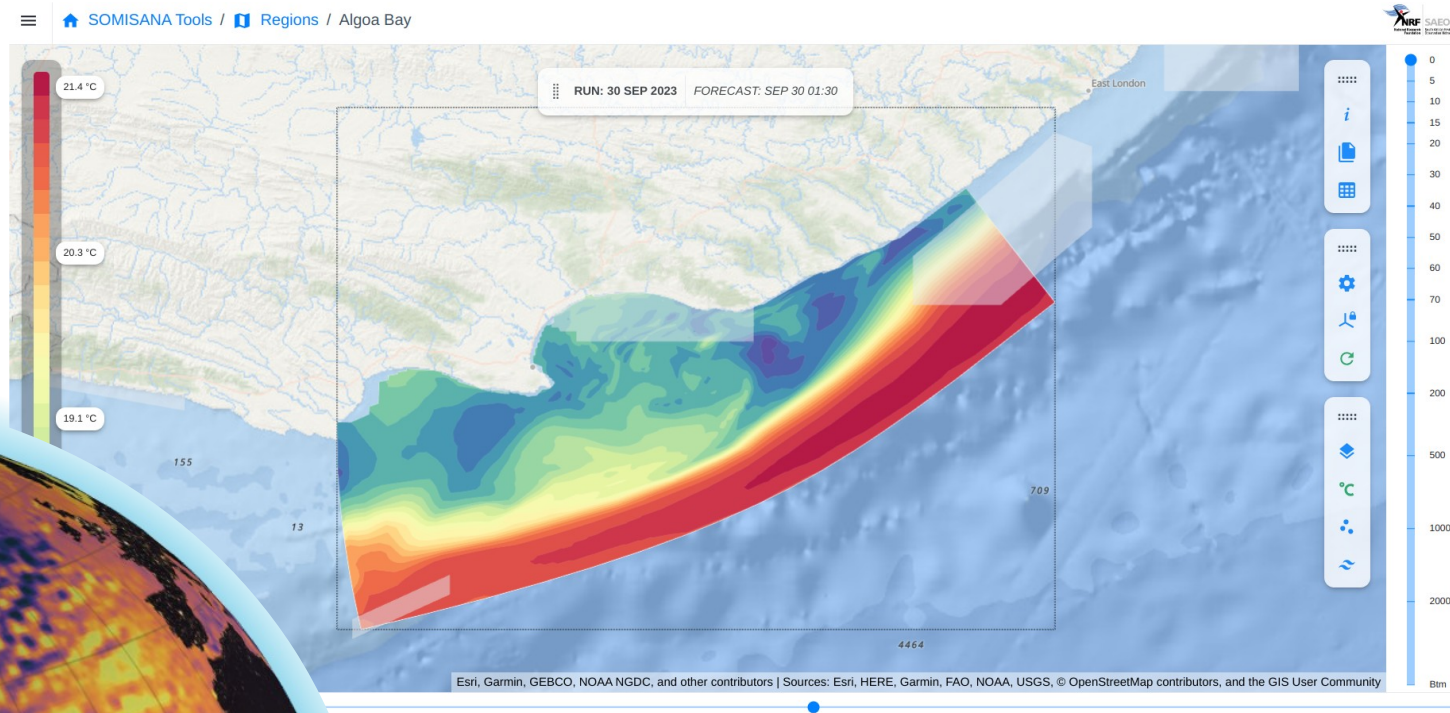
<https://explore.somisana.ac.za/>



South Africa's forecast system and services journey

SOMISANA: Operational Forecast Systems

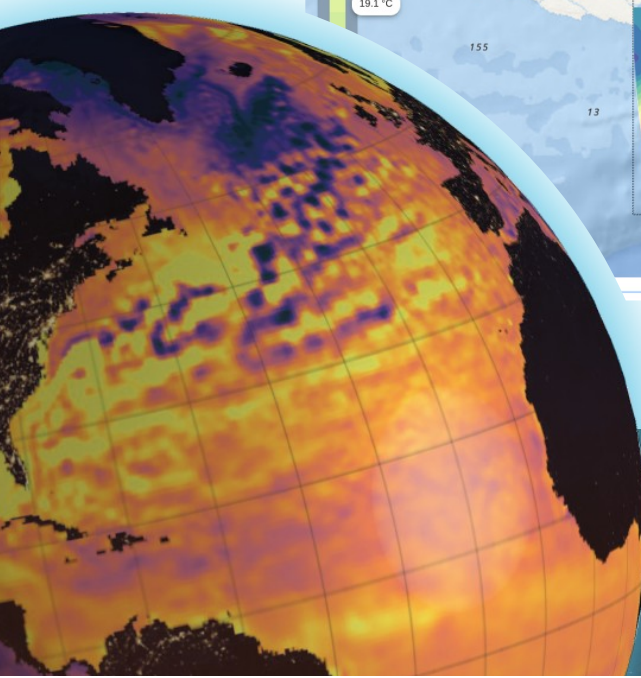
Visualization Portal, second iteration



Portal allows users to:

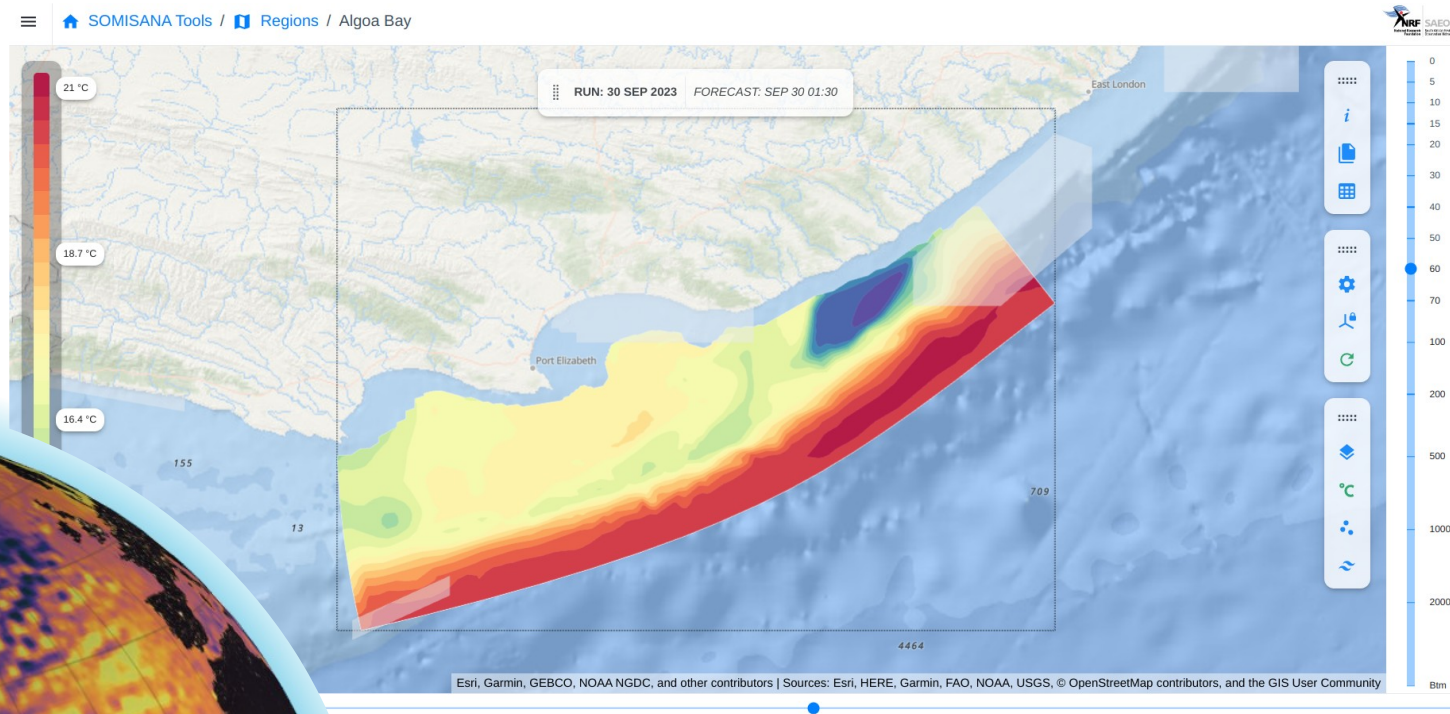
- ◆ zoom in and out
- ◆ configure their colormapping, scale and range

<https://explore.somisana.ac.za/>



South Africa's forecast system and services journey

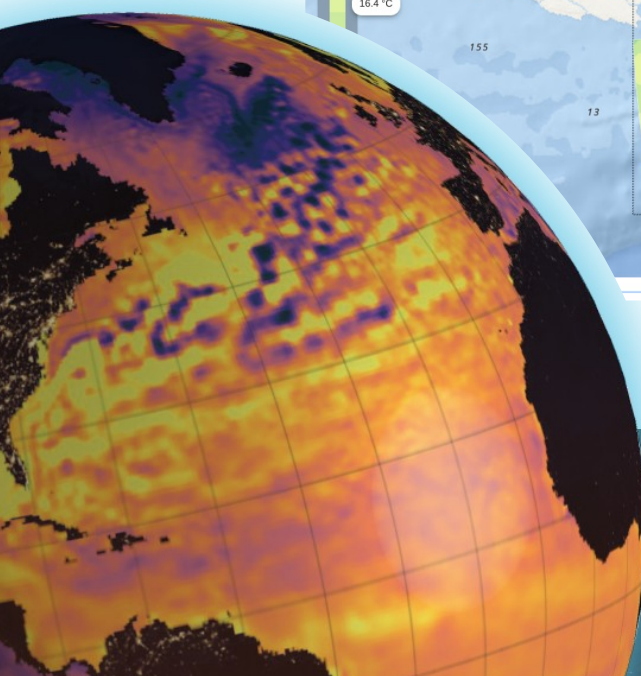
SOMISANA: Operational Forecast Systems Visualization Portal, second iteration



Portal allows users to:

- ◆ zoom in and out
- ◆ configure their colormapping, scale and range
- ◆ select depth

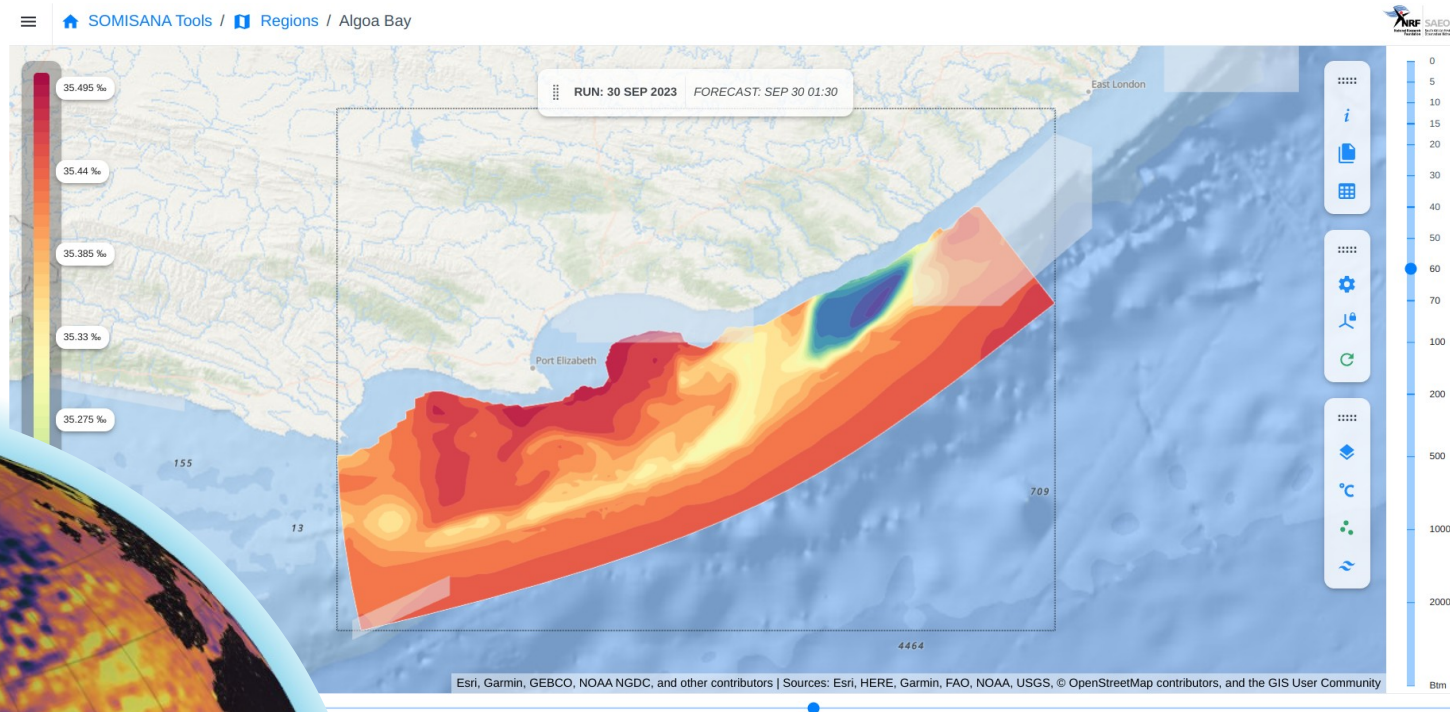
<https://explore.somisana.ac.za/>



South Africa's forecast system and services journey

SOMISANA: Operational Forecast Systems

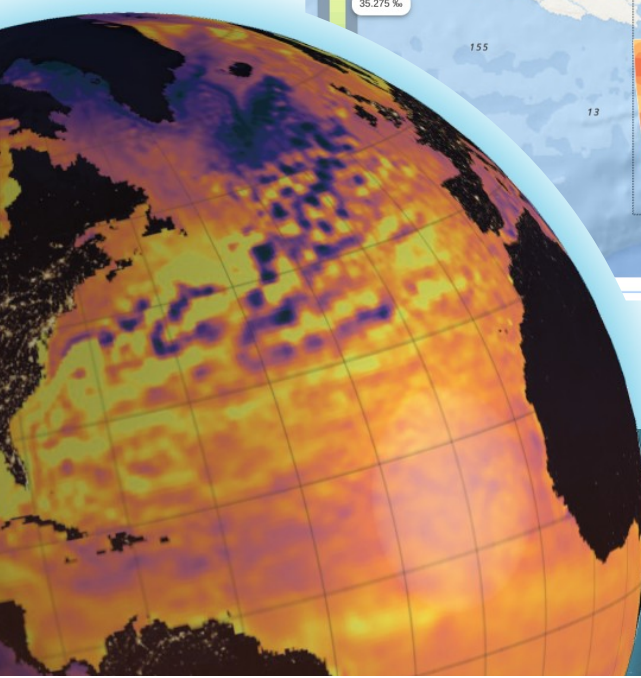
Visualization Portal, second iteration



Portal allows users to:

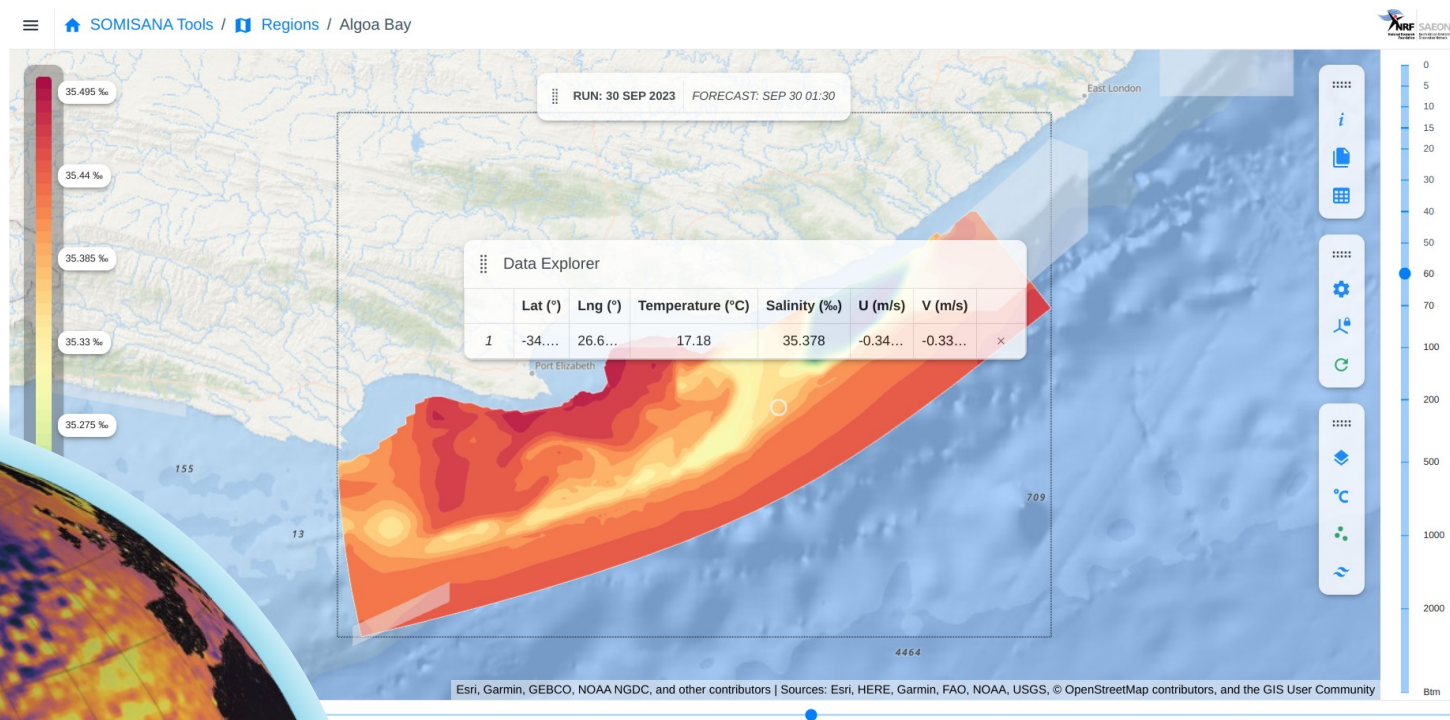
- ◆ zoom in and out
- ◆ configure their colormapping, scale and range
- ◆ select depth
- ◆ select variable

<https://explore.somisana.ac.za/>



South Africa's forecast system and services journey

SOMISANA: Operational Forecast Systems Visualization Portal, second iteration



Portal allows users to:

- ◆ zoom in and out
- ◆ configure their colormapping, scale and range
- ◆ select depth
- ◆ select variable
- ◆ select a point to view data

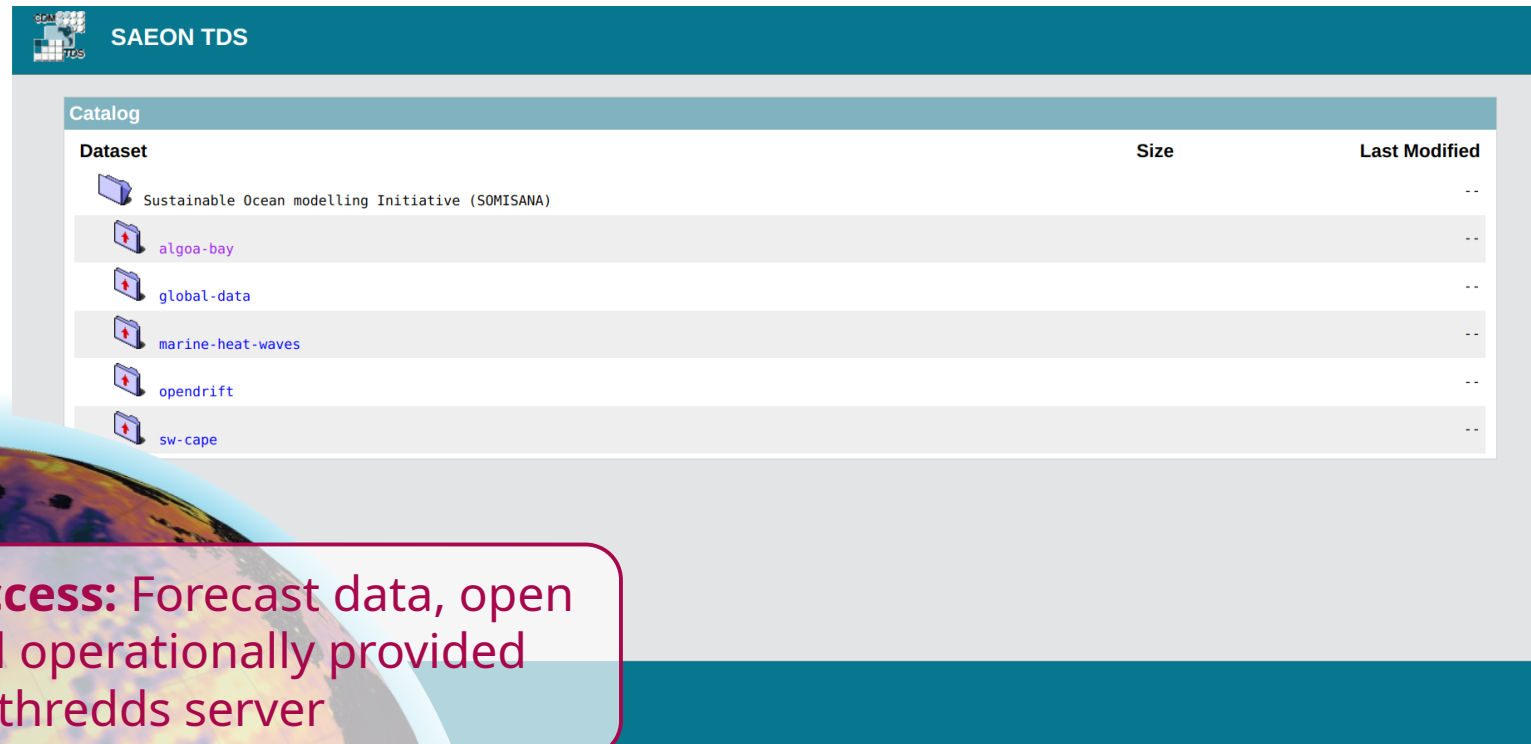
<https://explore.somisana.ac.za/>

Success: A sophisticated web portal that operationally disseminates forecasts

South Africa's forecast system and services journey

SOMISANA: Operational Forecast Systems

Data Access: thredds server



SAEON TDS

Catalog

Dataset	Size	Last Modified
Sustainable Ocean modelling Initiative (SOMISANA)		--
algoa-bay		--
global-data		--
marine-heat-waves		--
opendrift		--
sw-cape		--

Portal allows users to:

- ◆ zoom in and out
- ◆ configure their colormapping, scale and range
- ◆ select depth
- ◆ select variable
- ◆ select a point to view data

Daily 5-day forecasts are freely provided on a thredds server

Success: Forecast data, open and operationally provided via thredds server

Success: A sophisticated web portal that operationally disseminates forecasts

<https://thredds.somisana.ac.za/>

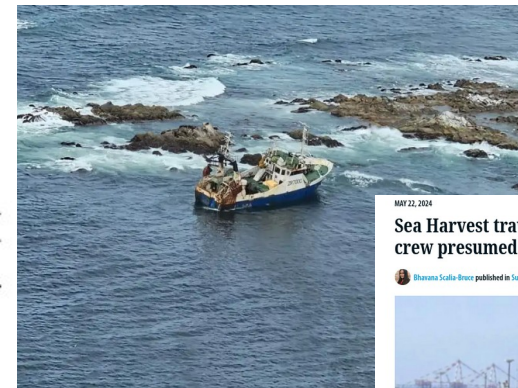
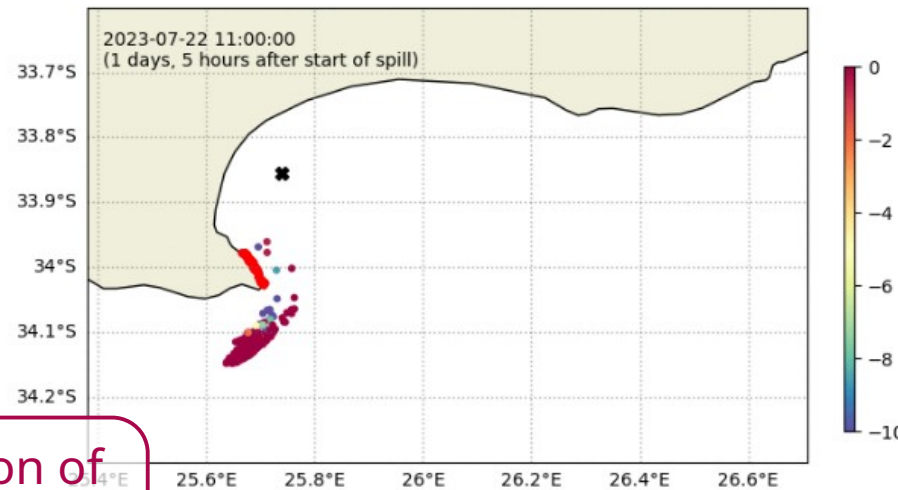
South Africa's forecast system and services journey

SOMISANA: Operational Forecast Systems

Added value product

◆ We are able to model a forecast spill/drift trajectory and make the data available via a file server, but with no user interface.

◆ Seamlessly integrates with global forecasts



MAY 22, 2024
Sea Harvest trawler sinks near Cape Town, 11 crew presumed dead

Shirana Scallo-Bravo published in Supply & Trade



Sea Harvest's FV Lugato sank on 17 May | Photo courtesy of SARDIA

Success: Transformation of forecast information into actionable intelligence

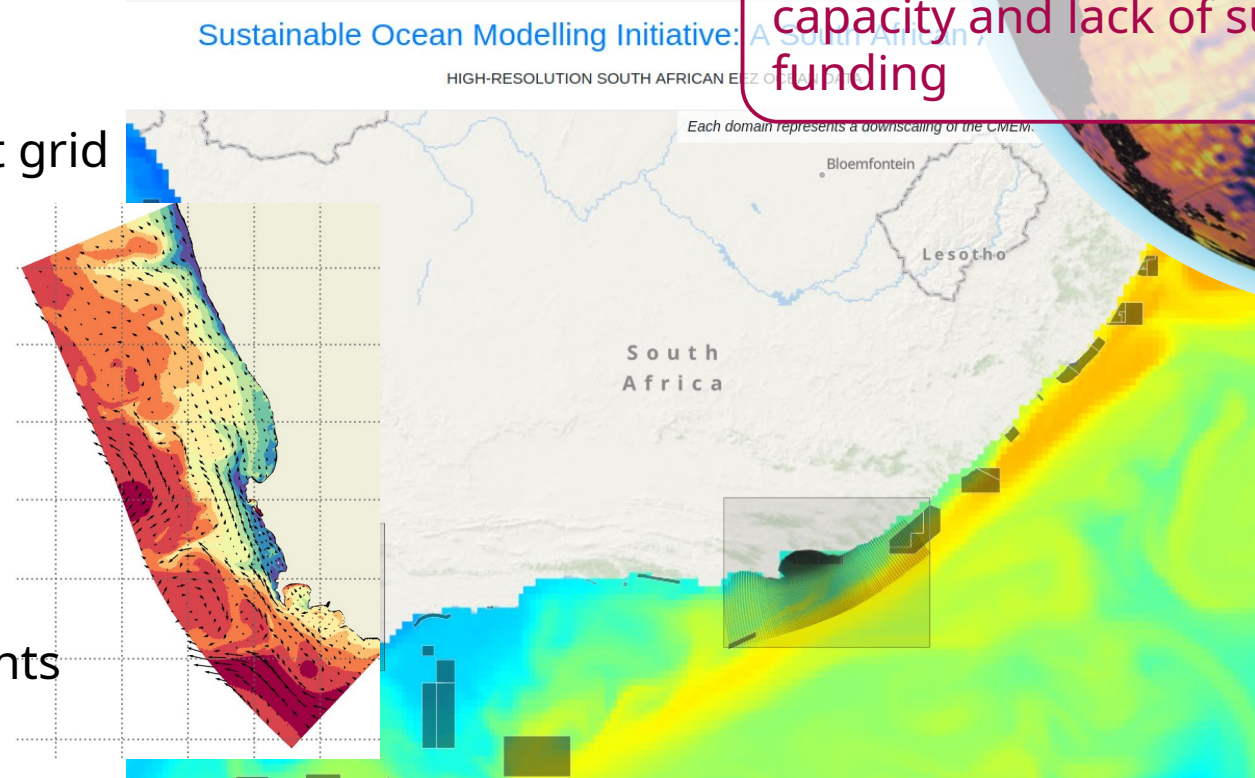


South Africa's forecast system and services journey

SOMISANA: Operational Forecast Systems

System Improvements

- ✦ An operational South African west coast grid
- ✦ Implementation of high resolution atmospheric forecasts courtesy of the South African Weather Service
- ✦ Not currently integrated into the visualization portal
- ✦ **COMING SOON:** forecast skill assessments
- ✦ **COMING LATER:** various system improvements incl. data assimilation



Threat: sub-critical human capacity and lack of sustained funding

South Africa's forecast system and services journey

SOMISANA: Operational Forecast Systems

Safeguarding our system



Risk: Human Capacity

Strategy: developing a fully redundant system that is not dependent on particular infrastructure or a particular human

The screenshot shows a GitHub Actions workflow named 'Run SOMISANA forecast models #545'. The workflow is triggered via a schedule and has a status of 'Success'. The total duration is 2h 29m 17s, and there are 3 artifacts. The workflow steps include: branch-ref, envs, toolkit, download-global-data, call_run_algoa-bay-forecast, and call_run_false-bay-forecast. The workflow file is named 'run_ops.yml' and is located in the 'actions' directory.

The screenshot shows the somisana GitHub repository. The repository is public and has 9 branches and 26 tags. The repository is managed by GilesFearon. The repository contains several files and directories, including .github, .husky, .vscode, _layouts, assets, deploy/we, docker, external-pi, models, and opendrift. The repository is described as 'SOMISANA-related tool' and has 2 stars, 3 watching, and 2 forks.

- ◆ Completely open-source
- ◆ Publishing our full forecast system workflow on a gitrepo with complete documentation.
- ◆ System is fully dockerized
- ◆ Ongoing upskilling / skills transfer

<https://github.com/SAEON/somisana>

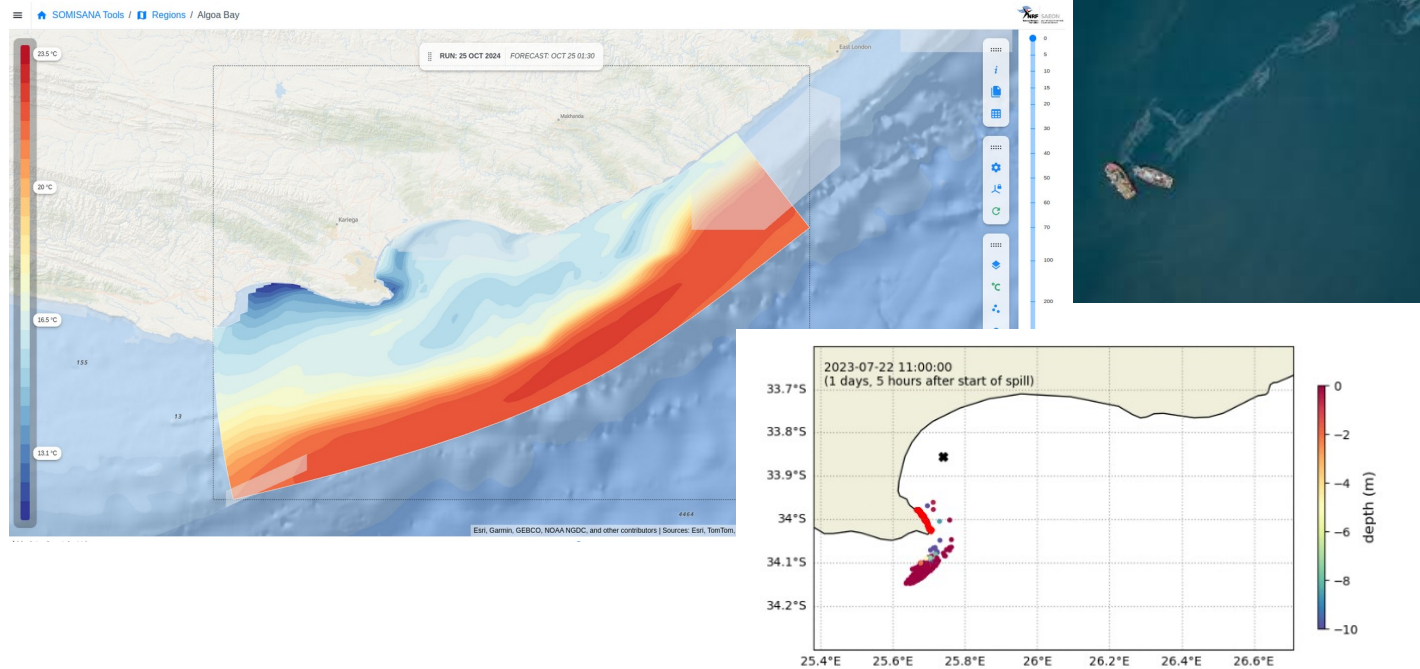
South Africa's forecast system and services journey

SOMISANA: Operational Forecast Systems

Safeguarding our system



Risk: Sustained Funding



Strategy: develop a system whose value far exceeds the cost of producing it.

To produce a system that provides services that are:

◆ Visible ◆ Robust ◆ Useful ◆ Trusted

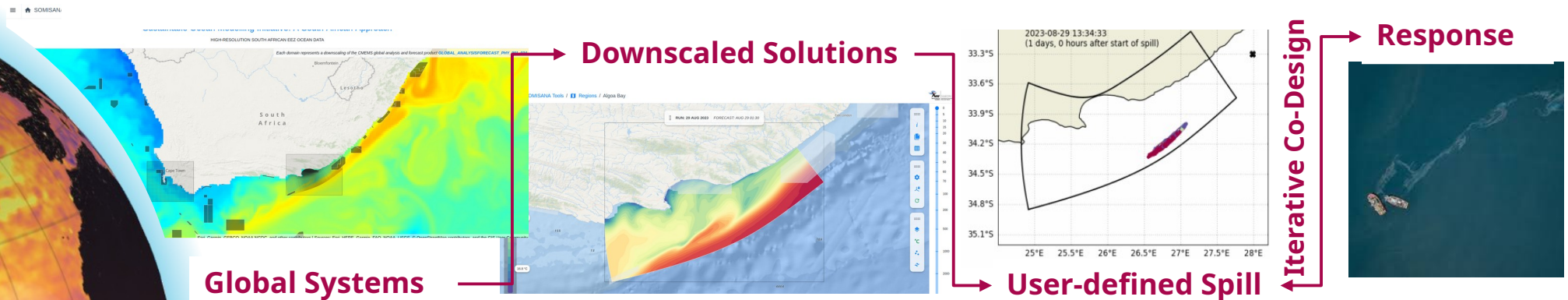
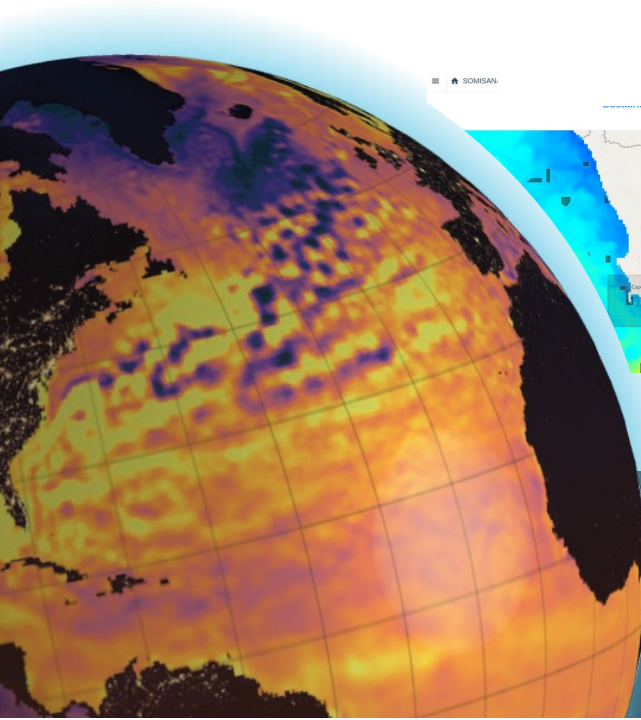
South Africa's forecast system and services journey

Moral of the story

Though **simple**, South Africa's forecast system **produces useful and actionable information**

It's success (now and in the future) depends on:

- ◆ High level support and funding
- ◆ Local, regional and international partners and collaborators
- ◆ Documented standards and best practices
- ◆ Open access and reliable global systems
- ◆ Stakeholder engagement and co-design
- ◆ Observations!

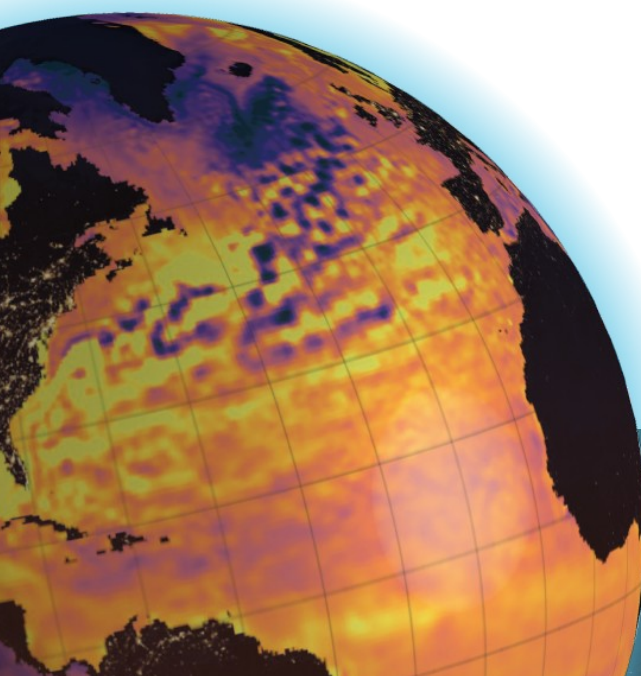
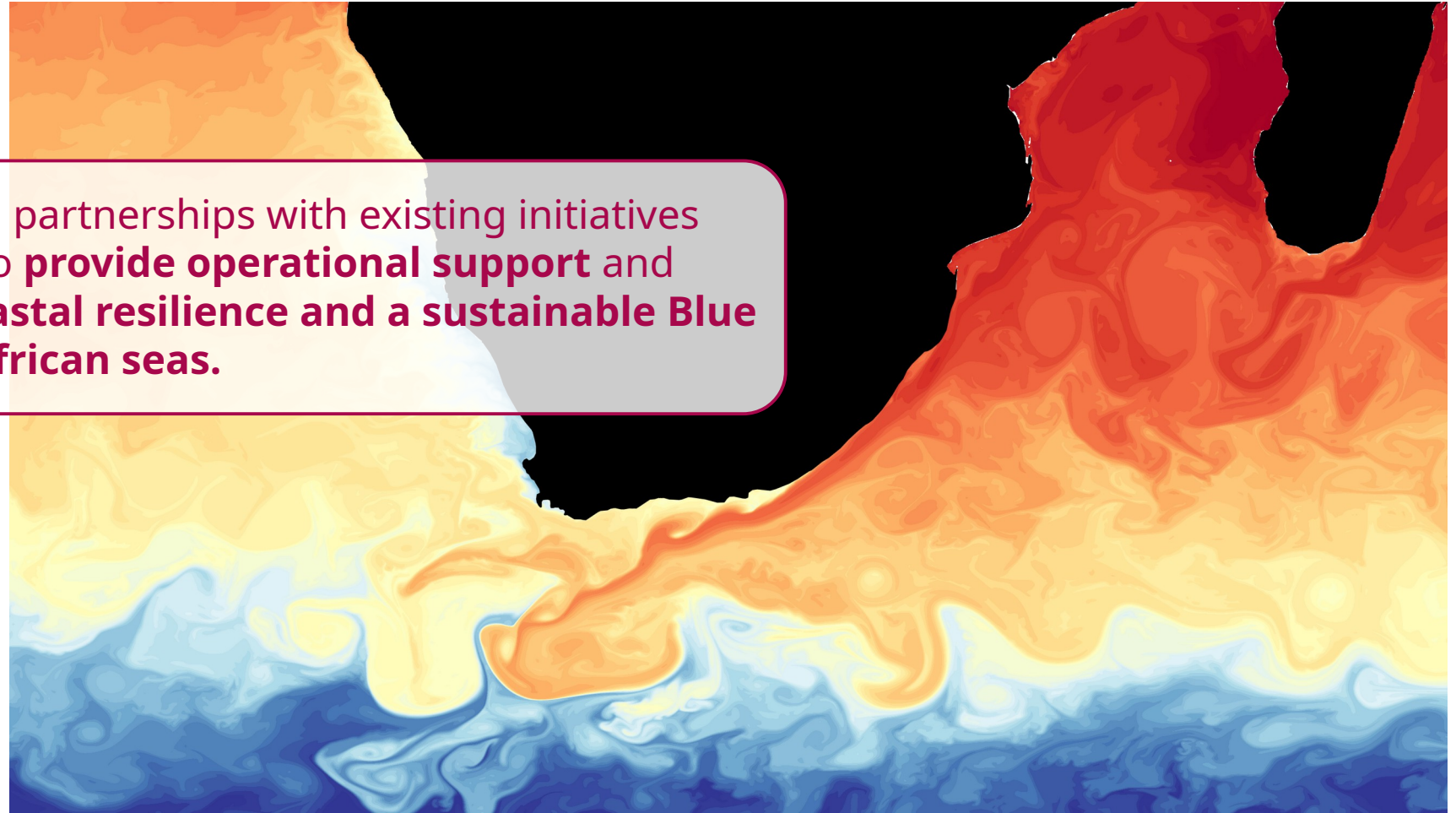


South Africa's forecast system and services journey

Way Forward



To **build connections** and partnerships with existing initiatives that **collectively** set out to **provide operational support** and actionable insights for **coastal resilience and a sustainable Blue Economy** for southern African seas.



In partnership with



Ubuntu

'I am a person through other people.
My humanity is tied to yours'
- Zulu proverb

Ubuntu

'I am a person through other people.
My humanity is tied to yours'
- Zulu proverb

The science **WE** need for the ocean **WE** want
demands that we embrace the spirit of Ubuntu



In partnership with



SYM POSIUM IUM

OP' 24

ADVANCING OCEAN PREDICTION
SCIENCE FOR SOCIAL BENEFITS

Thank you!

