OceanSAfrica is a multi-institutional initiative that seeks to develop operational oceanography capabilities in South Africa and Africa

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OceanSAfrica is a multi-institutional initiative that seeks to develop operational oceanography capabilities in South Africa and Africa

Aims

- Provide a strategically-directed *platform* amongst African marine research institutes for the identification, development and showcasing of new capabilities in the fields of ocean modelling, earth observation, in situ observation and dissemination technologies.
- Develop *vehicles to transfer* these capabilities to operationally mandated marine agencies.
- Develop new national and regional *human capacity and infrastructure* in the marine science, technological and technical domains.
- Create mechanisms for *focused and sustainable development* of this expertise and infrastructure.

OceanSAfrica operational oceanography

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Aims

- Facilitate the development of *new national structures* for operational oceanography and marine meteorology, concomitantly with the development of new government agency mandates in the domain.
- Scoping and implementation plans to form *regional and African partnerships* to transfer maturing domain-specific operational competencies from the research to the operationally mandated community.
- Provide regional components for *integration into international* operational and scientific programmes and commitments, such as JCOMM, GMES and GMES-Africa, and appropriate GEO, GOOS and GODAE tasks.

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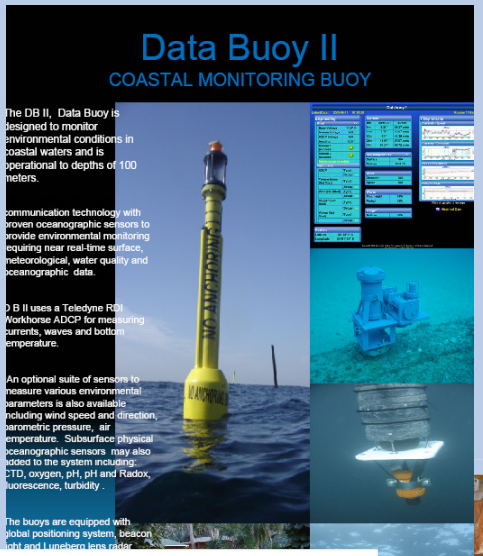
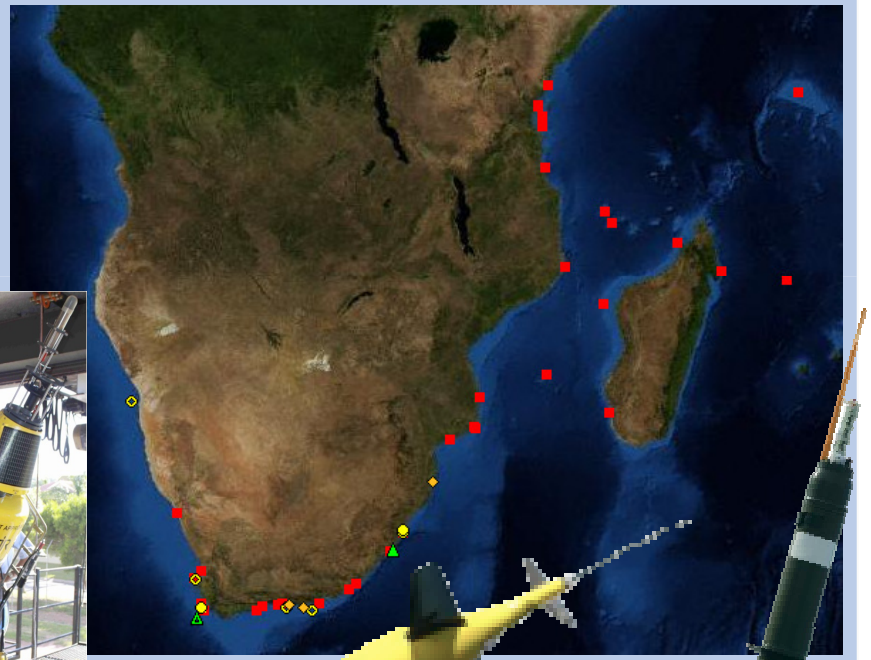
In Situ Observations: Expanding existing value and developing new scientific, technical and technological capabilities

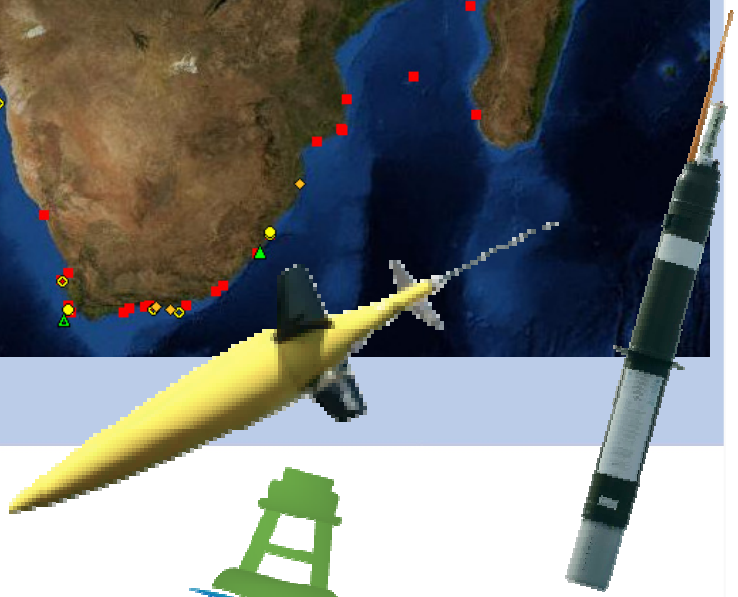


Example Existing DEA Capability
34 UTR sites throughout the SWIO
3 x coastal data buoys deployed at the moment in SA
1 x super buoy in 1000 m in Agulhas Current



SA developed buoys, ranging from deep oceanic through mid-size coastal to lightweight bio-optical, all providing real time multi-sensor capabilities

- 2013



Autonomous Profiling Centre in Cape Town to run new fleet of SeaGliders, WaveGliders & Bio-Argo floats primarily in Southern Ocean.

Profiling Centre will also conduct R&D and create new technical capabilities e.g. prototype low-cost floats and bio-optical sensors with aim of providing semi-expendable & distributable technology

Expansion of existing programmes e.g. well established ASCLME observational programme

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operational oceanography

In Situ Observations: Expanding existing value and developing new scientific, technical and technological capabilities

***In Situ* Observations**
Lead: Department of Environmental Affairs, Branch Oceans & Coasts

- Consolidating, expanding and adding value to existing autonomous and ship based observational facilities, particularly through improved communication links and near real-time data access.

- Developing new scientific and technical capabilities to use currently available autonomous platforms and sensors, such as gliders, profiling floats and buoys.

- Developing new low-cost, modular and distributable autonomous platforms and sensors such as miniature floats and semi-expendable bio-optical sensors, improving African *in situ* observational capabilities and the SET base.

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Southern Ocean Seasonal Cycle Experiment 2012

Seasonal scale climate and carbon cycle links

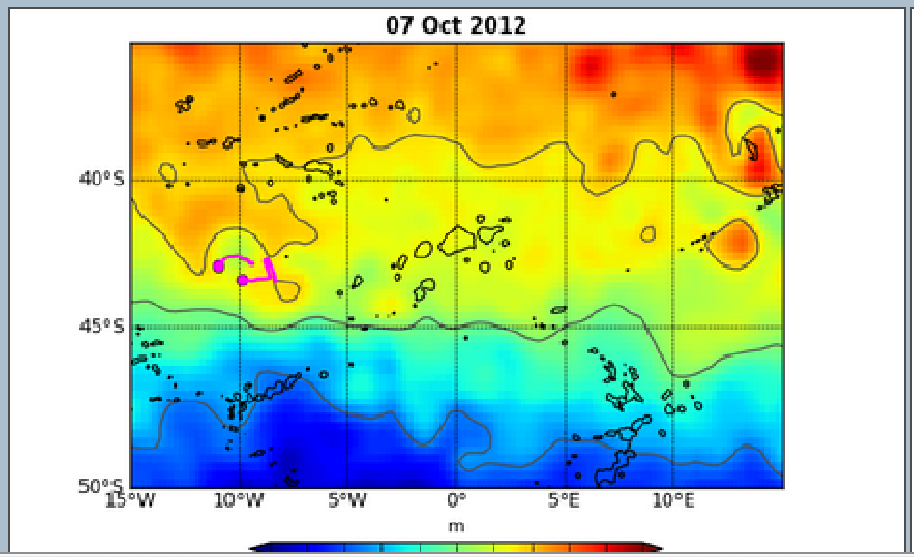
The Southern Ocean Seasonal Cycle Experiment (SOSCEx) provides a new and unprecedented opportunity to gain a better understanding of the links between climate drivers and ecosystem productivity and climate feedbacks in the Southern Ocean. This combined high-resolution approach to both observations and modelling experiments will permit us, for the first time, to address some key questions relating to the physical nature of the Southern Ocean and its carbon cycle.

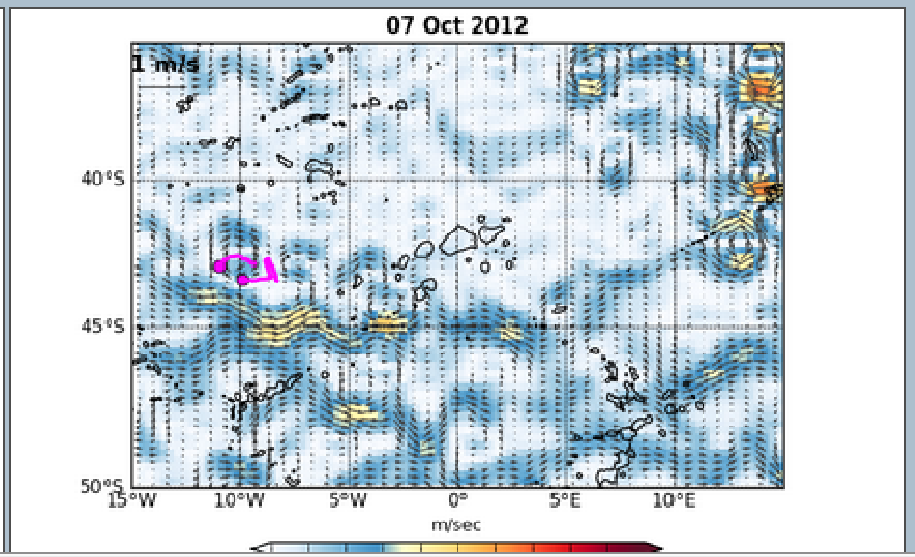
For SOSCEx, it is hypothesised that climate change signals will be reflected in changes to the magnitude, timing and persistence of the seasonal cycle in mixed-layer physics and biogeochemistry and, in particular, the carbon cycle. (For more details refer to Swart et al., 2012)

The figures below represent the present glider location in the Southern Ocean overlaid on the near-real time regional satellite sensed data: sea surface height (SSH) and surface geostrophic velocities. The SSH data provides a direct measurement of the water column density structure and hence locates regions of high density gradients, such as ocean fronts and jets or eddies and meanders. The geostrophic velocities are directly as a result of these density gradients, helping us to further identify oceanographic features and steer the gliders through current.

Glider 573 last seen 2012-10-08 18:57:05, 57 dives, average speed last 3 dives 0.38 km/hr.

Glider 574 last seen 2012-10-08 17:16:05, 79 dives, average speed last 3 dives 0.82 km/hr, Click images for zoom.





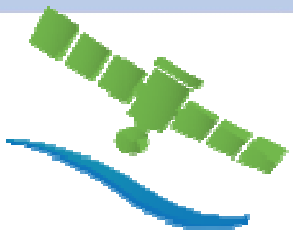
Remote Sensing: Algorithm & product development, calibration/validation, curation and dissemination

Remote Sensing
Lead: Council for Scientific and Industrial Research, NRE Earth Observation

- Consolidating, expanding and adding value to existing national and regional facilities, such as FP7 DevCoCast/EAMNet and AMESD/MESA, to provide routine earth observation data and user training for marine and freshwater domains across Africa.

- Developing new algorithms and products for African shelf-sea, oceanic and freshwater users and contributing to sensor and algorithm validation programmes for ESA and NASA.

- Maximising calibration/validation contributions and uptake readiness for forthcoming earth observation missions, strongly focusing on the Sentinel series for marine & aquatic physics & biogeochemistry.



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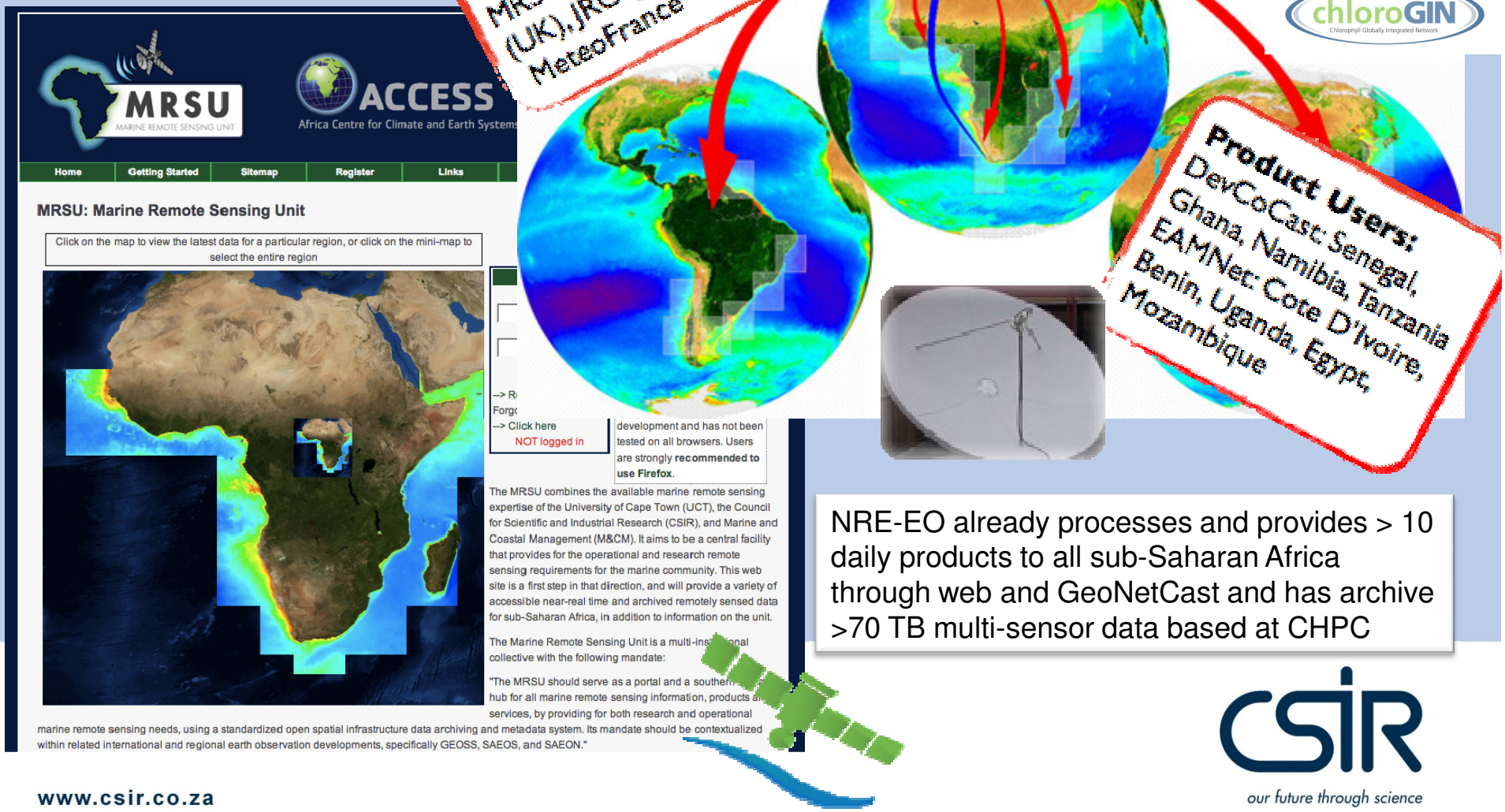
OceanSAfrica: Existing operational EO capabilities lead by the Marine Remote Sensing Unit, disseminating to users in Africa through EAMNet



NRE-EO already processes and provides > 10 daily products to all sub-Saharan Africa through web and GeoNetCast and has archive >70 TB multi-sensor data based at CHPC

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OceanSAfrica: Frequent maritime observations

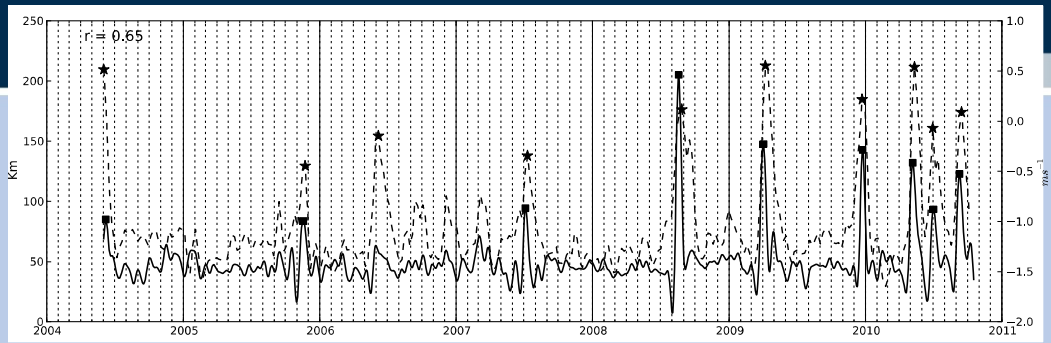
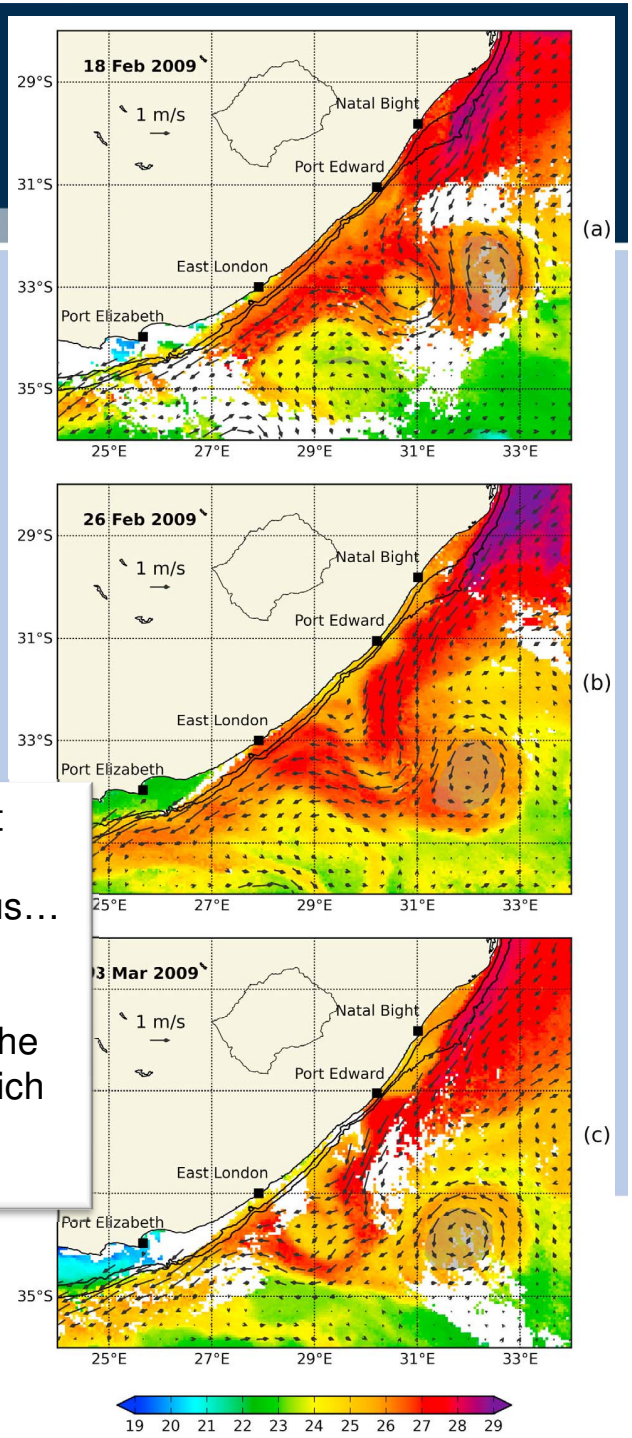
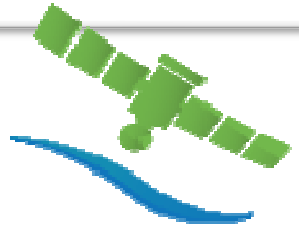


Figure 7. Variations in absolute geostrophic current velocities at the Agulhas Current core associated with the passage of Natal Pulses offshore Port Elizabeth. The low-passed position of the Agulhas Current's inshore front is plotted as a black line with Natal Pulses identified by black squares. The eastward current velocity extracted at 25.8°E, 34.7°S from the AVISO maps of absolute geostrophic velocities is plotted as a dashed black line with stars showing fluctuations in the eastward current velocity greater than 1 standard deviation. A Pearson's correlation coefficient *r* of 0.65 is found between the 7 day low-pass time series of the Agulhas Current inshore front and the absolute eastward geostrophic velocity at the Agulhas Current core. The correlation coefficient *r* is highly significant at the 99% confidence interval. Solid vertical lines mark 1 January for each year, while the vertical dashed black lines indicate the beginning of each month.



The Agulhas Current, one of the most important shipping lanes in the global ocean, and one of the most dangerous…

Combined data from sea surface temperature and altimetry can show the location and speed of the current (which can be highly variable) in near-real time….

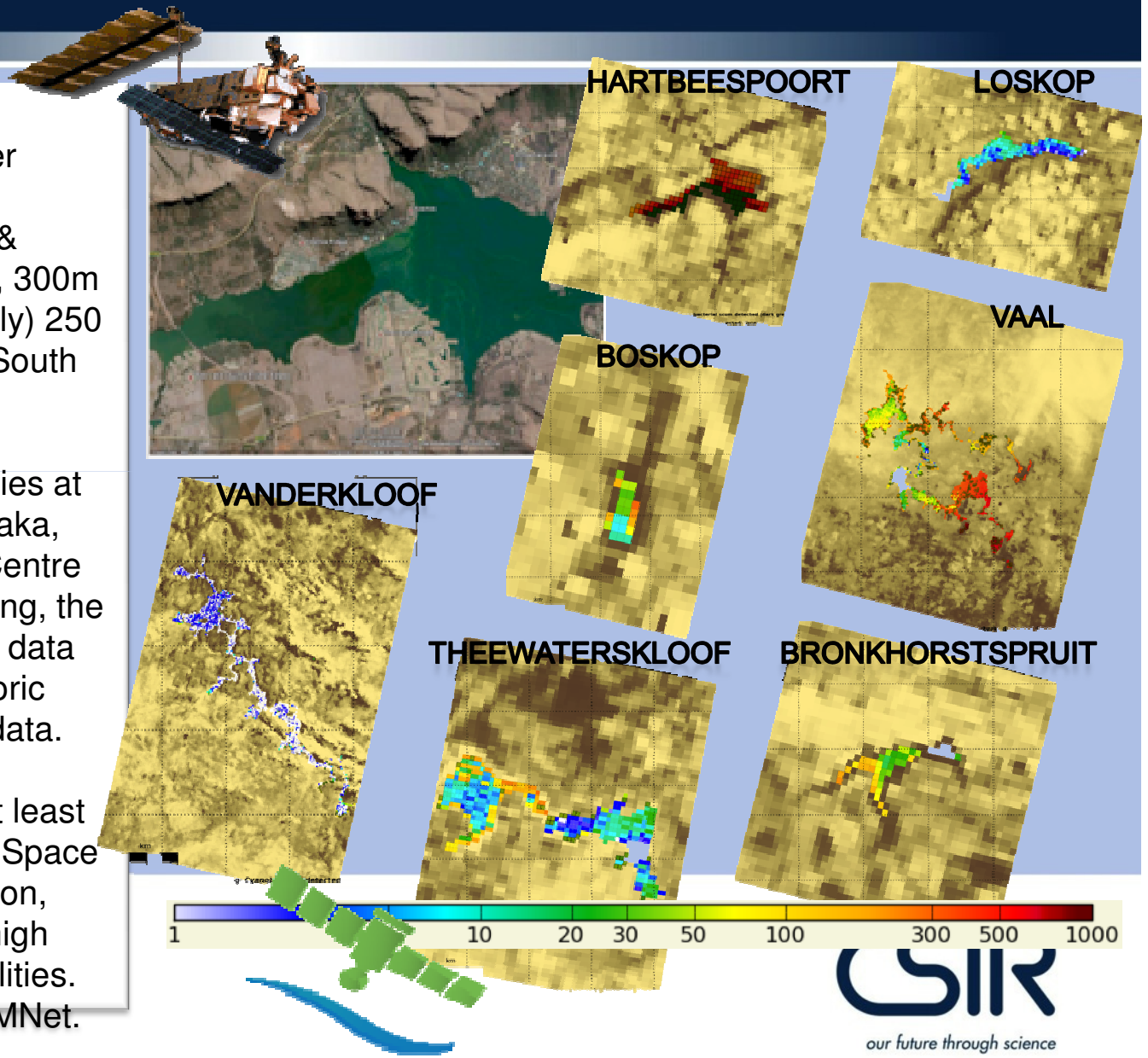


Earth Observation: freely available, routine, water quality mapping

Eutrophication indices, cyanobacterial indicators, water clarity and other water quality products derived from MERIS & MODIS sensors at sub-weekly, 300m – 500m resolution for (ultimately) 250 major dams and reservoirs in South Africa.

Based on established capabilities at NRE Earth Observation & Meraka, and using the facilities of the Centre for High Performance Computing, the system will offer near real time data and access to 10 years of historic data, synthesising ± 30 TB of data.

Sensor continuity is assured at least to 2020 through the European Space Agency's Sentinel 3 constellation, with Sentinel 2 offering novel high resolution water quality capabilities. African expansion through EAMNet.



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operational oceanography

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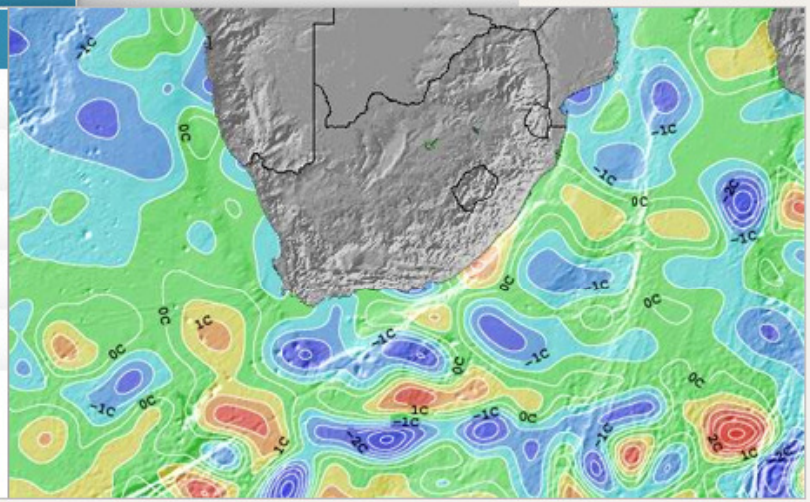
Current Marine Conditions

Forecast Marine Conditions

- Temperature
- Currents
- Wave Height
- Marine Winds
- Harmful Algal Blooms
- Oil & Pollution



About OceanSAfrica

Who we are

OceanSAfrica is a multi-institutional initiative that will develop operational oceanography capabilities in South Africa and Africa. Conceived at the first African Operational...

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What we do

The vision of OceanSAfrica is, through a combination of modelling and observations, to deliver regular and systematic information on the state of the ocean that is of known quality...

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Why we do it

Designed to develop and showcase substantial national, regional and African marine science capabilities in order to build critically needed capacity and benefit society...

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Science

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Marine Conditions

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Modelling & the SimOcean Initiative: Developing expertise, validation & dissemination of existing models, towards fully assimilative capabilities

Ocean Modelling & Assimilation: SimOcean
Lead: Department of Oceanography, University of Cape Town

- Developing South African and regional expertise and capacity in regional ocean modelling and data assimilation to predict the ocean state. Assessing regional ocean current and wave forecasting models for critical southern African shelf sea regions using the ROMS, HYCOM and Deltares platforms.

- First stage demonstration of data assimilation capabilities using HYCOM with the aim of generating long-term regional ocean hind- and forecasts with direct application to both operational forecasting and reanalyses, for a wide variety of users.

- Building capacity and regional expertise in numerical ocean modelling and operational forecasting through postgraduate/short course training and provision of modelling tools and code modules.

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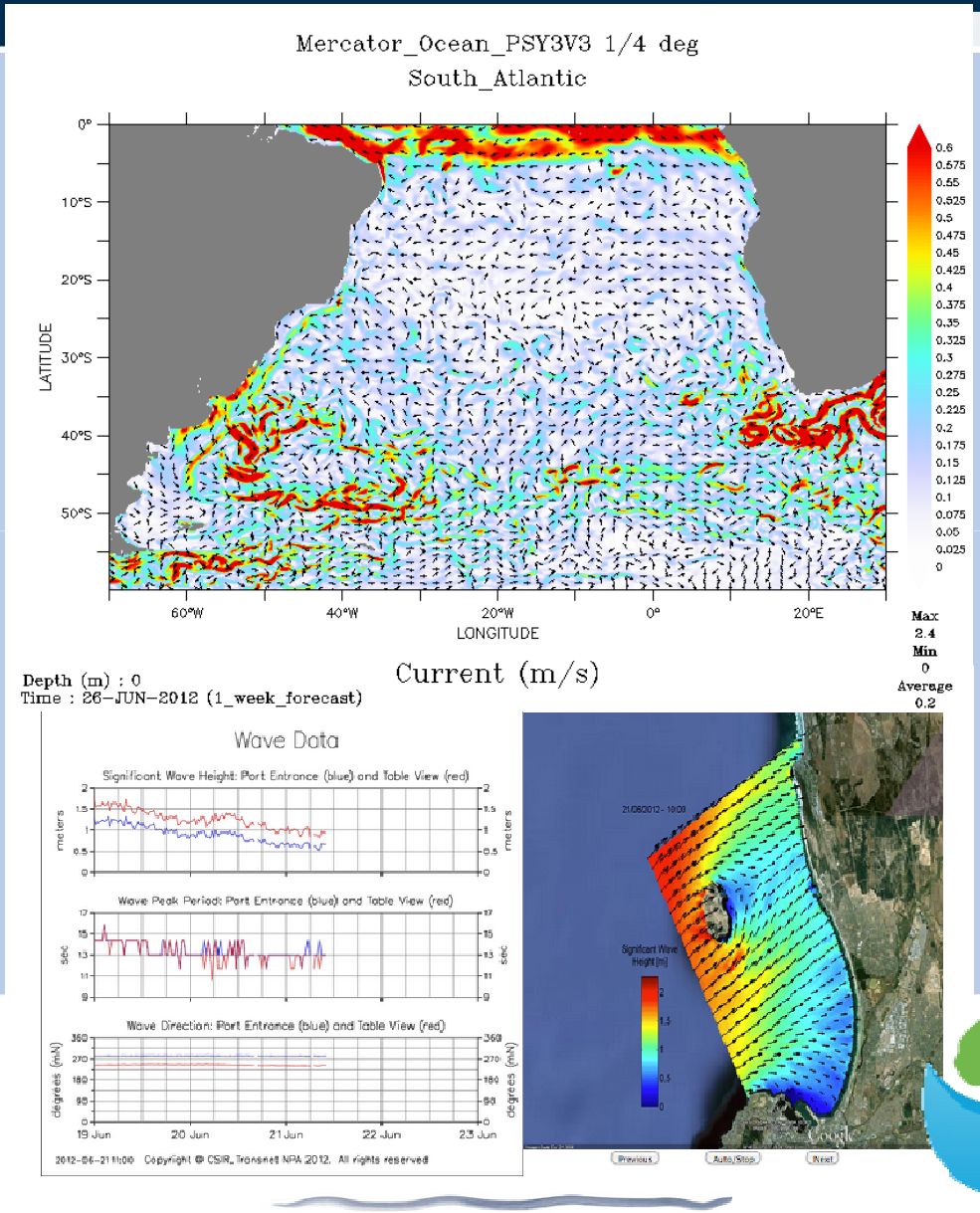
OceanSAfrica: Forecast products from existing real-time models at different scales



One of the primary aims of operational oceanography is forecasting: the prediction of the physical (or even biological) state of the ocean at both the basin and bay scale. Such data are critical for maritime operations, search and rescue, tracking spills or blooms, prediction of storm surges etc…

OceanSAfrica is developing regional modelling capabilities with a long term aim of running real-time operational models that assimilate observations across a wide variety of scales. DITAOLA will provide data from current capabilities: bay scale Deltares/SWAN models for Saldanha, Table & Algoa bays (NRE Coastal RG and Built Environment) and regional ¼ degree temperature and current data products from the Mercator project…

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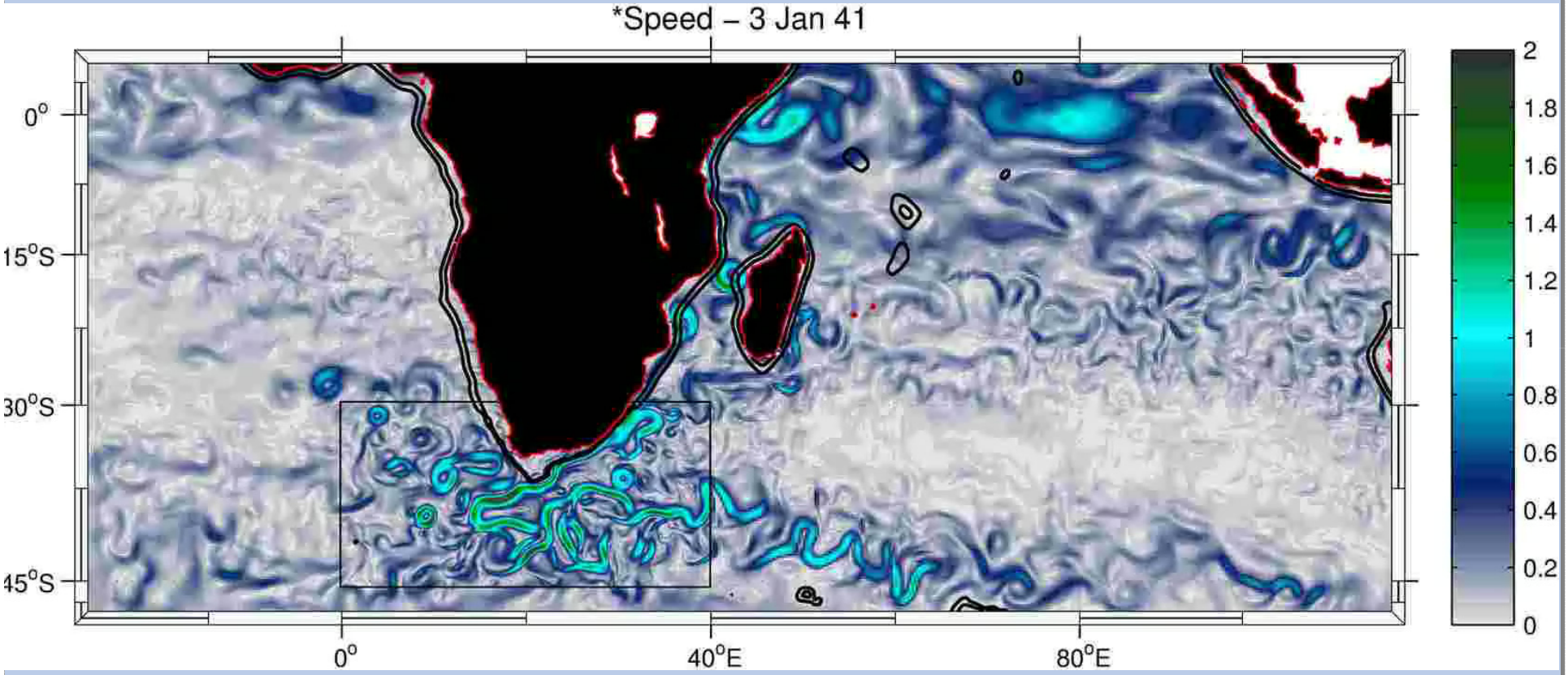
SimOcean: Example of developing capabilities – new 1/12 degree ROMS 2nd nest for eddy resolving dynamics



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Courtesy Ben Loveday, Bjorn Backeberg

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Dissemination: integration, dissemination, curation

Dissemination
Lead: South African Environmental Observation Network (SAEON)

- Integrate data and products into a powerful, user friendly, multi-media distributed dissemination system, delivering products of value to an extended user community. Products will include rapid environmental assessment of the marine and coastal environment, especially high risk extreme events and climate related change impacting on people, and support for the management of economically important offshore industries.

- Specify and develop a set of guidelines, standards and reference implementations for a data management system capable of ensuring inter-operability for operational oceanography. Build and host a standardised meta-data repository where products, data sets, documentation and appropriate reports can be categorised and discovered.

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Information Systems: easily used web & cellular based products

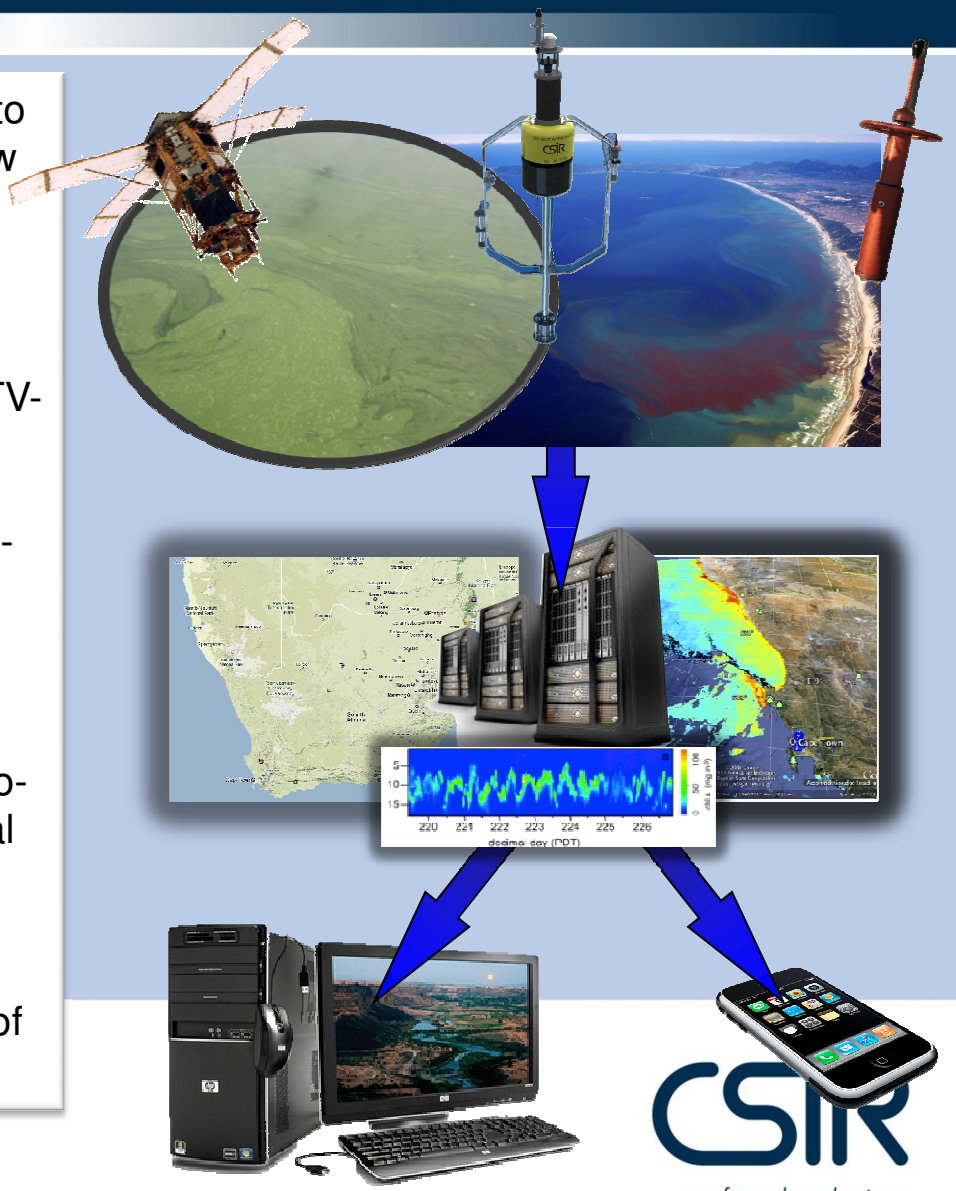
Integrated dissemination system, allowing users to retrieve/receive highly tailored products with a few mouse clicks….

Archive, process and disseminate data & downstream products from all relevant platforms through web, cellular and GeoNetCast (satellite TV-like) systems…

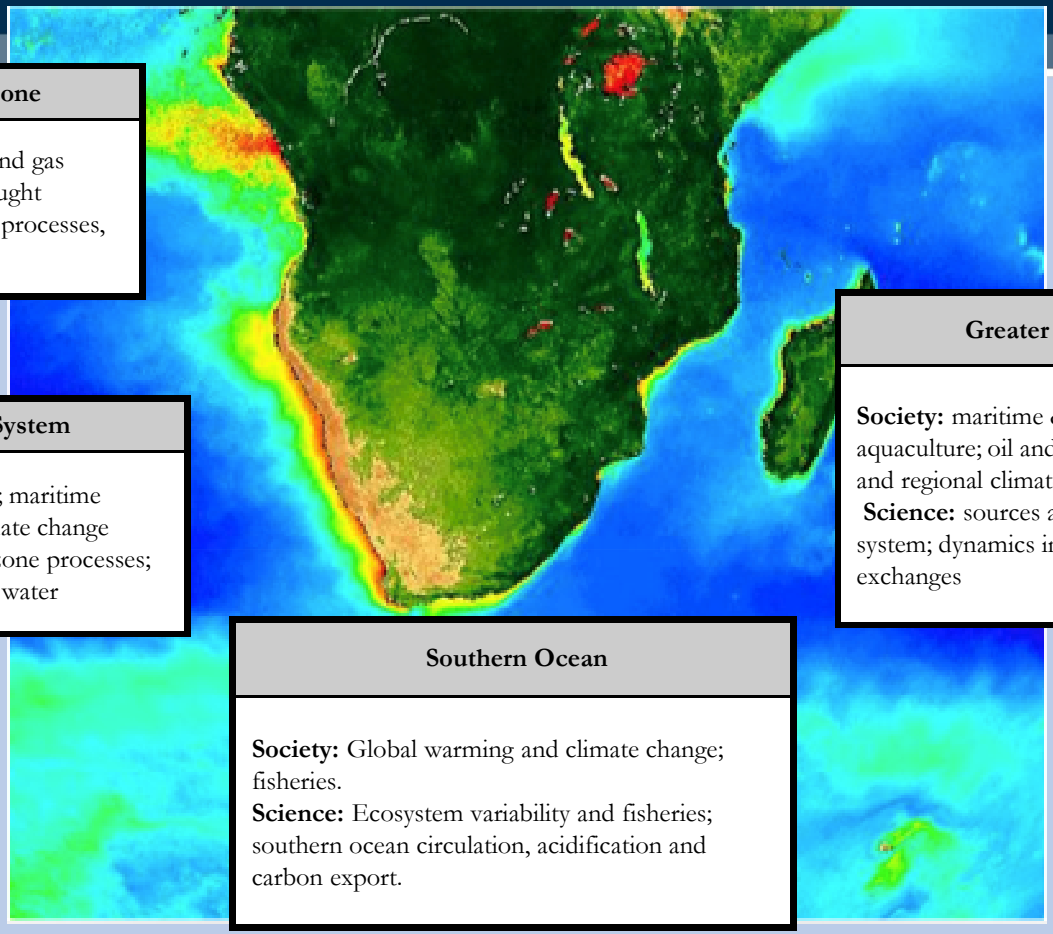
Based on combination of Meraka AFIS, NRE afro-sea, and SAEON/DST Earth Observation portal, using CHPC/DIRISA (Data Intensive Research Infrastructure for South Africa) infrastructure…

Interoperable: able to integrate with any other geo-spatial systems e.g. Green/Blue Drop, operational met systems e.g. GeoNetCast…

Modular & Open Source: flexible, very low development & maintenance costs, further ease of integration…



OceanSAfrica: Realising the Societal Benefits of Marine Observations and Forecasting



Angola-Benguela Frontal Zone

Society: hake and other fisheries; oil and gas production; oceanic impacts upon drought
Science: Benguela Nino; frontal zone processes, low oxygen water

Benguela Upwelling System

Society: fisheries and aquaculture; maritime interests; indicator system for climate change
Science: Benguela Nino; frontal zone processes; harmful algal blooms; low oxygen water

Greater Agulhas Current Region

Society: maritime & shipping interests; fisheries and aquaculture; oil and gas production; impacts on global and regional climate change
Science: sources and variability of the Agulhas Current system; dynamics in the retroflection region; inter-ocean exchanges

Southern Ocean

Society: Global warming and climate change; fisheries.
Science: Ecosystem variability and fisheries; southern ocean circulation, acidification and carbon export.

Developing World Class Scientific & Operational Capabilities

Climate Models: Improving the confidence of current models; integrating regional and global model forecasts.	**Remote Sensing:** Real-time observation of sub-Saharan Africa using a multitude of sensors; showcasing cutting-edge regional applications.
Ocean Models: Simulating and characterising the coupled ocean-atmosphere system; real-time prediction of marine systems.	***In Situ* Observation:** Developing world-class technology to observe the oceans using ships, moorings, and autonomous vehicles.
Dissemination Systems: Allowing the archiving, exchange and interpretation of data and products to a wide variety of end-users, using inter-operable systems and OGC compliant architecture. The integration of systems into a "system of systems".	