GMES and Africa Action Plan

Chapter 6. "Marine and Coastal Areas"

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Geoff Brundrit[1]; Nicolas Hoepffner[2]; Justin Ahanhanzo[3], Rezah Badal[4], Stewart Bernard[5], Gilbert David[6], Mark Dowell[2], Harm Greidanus[2], Steve Groom[7], Mika Odido[8], Paolo Roggeri[2], Lucy Scott[9], George Wiafe[10] and Winfried Wiedemeyer[11]

[1] Global Ocean Observing System in Africa, oceangeoff@iafrica.com; [2] EC-JRC, Institute for Environment & Sustainability, nicolas.hoepffner@jrc.ec.europa.eu, mark.dowell@jrc.ec.europa.eu, harm.greidanus@jrc.ec.europa.eu, paolo.roggeri@jrc.ec.europa.eu; [3] Intergovernmental Oceanographic Commission (IOC/UNESCO) and GOOS-AFRICA, j.ahanhanzo@unesco.org; [4] Mauritius Oceanography Institute MOI, rezahmb@moi.intnet.mu; [5] Earth Systems Earth Observation, CSIR – NRE, sbernard@csir.co.za; [6] IRD La Réunion, gilbert.david@ird.fr; [7] Plymouth Marine Laboratory, sbg@pml.ac.uk; [8] IOC Sub-Commission for Africa and the Adjacent Island States, UNESCO Regional Bureau for Sciences in Africa, m.odido@unesco.org; [9] ASCLME Project, lucy.scott@asclme.org; [10] Guinea Current Large Marine Ecosystem Project (GCLME), wiafeg@ug.edu.gh; [11] ICZM Consult International, wwiedemeyer@iczm-consult.com

Executive Summary

The sustainable management of the coastal and marine resources and environmental services for continued development in Africa requires the establishment of a pan-African Earth Observation (EO) monitoring and data management and analysis system to understand long term environmental trends, and develop appropriate management responses. Such an Africa-wide system would have to be supported by a consistent user-driven management structure and a sustainable budgeting and funding mechanism. The GMES and Africa Service for Marine and Coastal Areas proposed here describes such a system which comprises the following components, focused on providing services on a Large Marine Ecosystem (LME) scale through regional implementation centres:

- A Network of Marine Remote Sensing Centres as fully operational successors to existing pilot facilities, such as AMESD/MESA and EAMNet, utilizing satellite observations and developing new capabilities based on the new generation of GMES Sentinel satellites.
- A Network of Coastal Observatories, gathering in situ observations from priority areas such as mega cities, ports, areas of offshore industrial activity, and localities at risk from natural disaster and the impacts of climate change.
- A Network of Modelling and Forecasting Centres, providing products of value direct to the public and private user communities around the coast of Africa, such as state of the marine environment reports, operational coastal sea level, circulation and sea state downscaled to localities at risk, ecosystem health reports and coastal vulnerability atlases, and to downstream service providers.
- An African Capacity Building Network of Higher Education Institutions linked closely to the other components and with strong links to industries and Governments, where trained and empowered scientific, technical and management staff will be needed to generate, disseminate and utilise marine and coastal products of value.

The above structures, focusing and integrating multi-domain expertise across regional or ecosystem issues, will provide impacts at several levels. On a scientific level, the LME focus will maximise the value of data from the Sentinel series of satellites, providing regional validation of core service products and ecosystem-contextualised products integrating satellite, in situ and modelled data. From an operational service perspective, the network of centres will provide a common technical framework that will allow rapid service implementation and expansion of existing Regional Implementation Centres from the 2013-2018 Monitoring of Environment and Security in Africa (MESA) project. This large Project shall contribute to further detailing and contributing to the development of GMES & Africa Services from 2013 onwards. Those effective, regionally tailored, operational services will then ensure sustainable data and information provision to stakeholders, they will also provide capacity building networks, create mechanisms to participate in and disseminate on-going research, expertise and lessons-learned.

2. Introduction

1.1 Thematic Context

With more than 35,000 km of coastline, coastal and marine environments play a vital role in socio-economic development of many African countries, contributing significantly to national Gross Domestic Products (GDPs), to food security, and supporting a wide range of coastal livelihoods. According to NEPAD (2005), the coastal and marine fishery sector provides vital contributions to the protein needs of 200 million people in Africa. In several African countries, marine products account for 60% of the total protein intake. Biodiversity and natural assets of African coasts are important attractors for tourism and overseas industries. In some countries, many of them Small Island Developing States (SIDS), tourism represents not only the largest employment sector but accounts for significant contributions to national GDPs, for example up to 60% in the Seychelles (WTTC 2005).

In recent years, increasing coastal migration, urbanisation (50% of the population lives within 100 km of the coast) and industrial development, have driven negative environmental trends and have led to the unsustainable use of coastal and marine natural resources. Inappropriate zoning and coastal land use, as well as the lack of environmental management and the overexploitation of coastal and marine resources have also led to the degradation of coastal water quality, especially around coastal cities. Areas of high biodiversity such as coastal wetlands, mangrove forests and coral reefs are increasingly threatened by development and natural hazards, with a net loss of several hundred thousands of hectares of intact ecosystems over the last 25 years. Overfishing over four decades, whether illegal, unregulated or regulated by unsustainable international agreements, has contributed to a massive decline in fish stocks, particularly off West Africa. By 2002, demersal fish stocks in northwest African coastal and shelf waters had been reduced to a quarter of their levels in 1950 (OECD 2007), contributing to destabilising the economies of several many coastal African countries that rely on fisheries for their GDP.

Coastal and marine ecosystems play an important role as carbon sinks, thus mitigating global climate change significantly. Their sustainable environmental management is thus imperative. According to the Intergovernmental Panel for Climate Change (IPCC), “Africa is one of the most vulnerable continents to climate change and climate variability, a situation aggravated by the interaction of multiple stresses, occurring at various levels, and low adaptive capacity” (Boko *et al*. 2007). For example, IPCC-projected sea level rise will increase the number and severity of coastal flooding events causing further severe damage to the coastal and marine environments and the resources and services they provide, and ultimately endanger even more coastal populations and economies.

The thriving but still young and fragile private sector, which is increasingly contributing to the economic development of many African coastal nations, is also highly dependent on the availability of natural resources, access to environmental services and protection (security) against anthropogenic and natural hazards and disasters.

Earth Observation (EO) products and information will significantly enhance the quality of marine and coastal environmental and economic management and thus contribute to the sustainability of development in all African coastal countries. Such products and information shall derive from a GMES and Africa Marine and Coastal Service, which needs to be established in cooperation between the countries of the African region with support from the international community.

The joint Africa-EU strategy (JAES) was adopted at the second Africa-EU Summit (2007) and confirmed at the third summit in 2010. The eight partnership themes developed are: Peace and Security; Democratic governance and Human rights; Trade, regional integration and infrastructure; Millennium Development Goals; Energy; Climate change and Environment; Migration, mobility and employment; Science, Information Society and Space. The 8th theme on Science, information society and space, has three components: *To strengthen African Capacities in the area of science and technology; to support the development of an inclusive information society in Africa; to enhance Cooperation on Space Applications and technology.*

The Joint Africa-EU Strategy Support Mechanism is the concrete materialisation of Joint Africa-EU Strategy and its Second Action Plan (2011-2013), adopted in the Africa-EU Summit of 2010. It aims to offer a flexible and demand-driven assistance mechanism to address implementation difficulties and to provide the necessary technical, administrative and secretarial support for the implementation of the JAES Action Plan.

1.2 Pressures and Constraints

In spite of the great potential for satellite data to provide reliable and timely monitoring of the marine and coastal environment in Africa, several constraints have been identified by user groups regarding the operational use of acquirable data and metadata. Identified constraints are: insufficient access to data, limited frequency of measurements, lack of appropriate infrastructure for data reception and analyses, absence of local in-situ calibration and validation programmes, as well as inadequate mechanisms of information dissemination to user groups and communities outside the scientific community. There is still a communication and participation gap between the scientific community and the management/policy user community that needs to and should integrate EO data and information into coastal and marine planning and management in Africa.

Although several national, regional and international organisations (some of which are listed in Annex I: Table 1) have invested in capacity building activities in recent years, the maintenance and improvement/strengthening of institutional, human and infrastructural capacity related to EO is an on-going challenge. Short term training courses as well as degree courses are an important component of capacity building that must be supported on an on-going basis. Coupled with that, investment in retaining capacity, providing jobs and supporting on-going maintenance of systems and infrastructure is critical. This is further addressed in section 6.2.

2. Policy Drivers and Needs Analysis

The implementation of international and regional coastal and marine conventions and respective national legislation and policies in Africa requires intensified research, the establishment of data and information frameworks and the creation of analytical capacities. Further context is given in Annex II. Given the prevailing shortage of financial means available for EO-related interventions in many African States, there is a growing need for: national and regional networking, EO data acquisition and exchange, as well as the establishment of regional EO databases that would (cost-) efficiently support the implementation of national, regional and continental marine environmental programmes.

It is globally accepted that the management approaches and principles of Integrated Coastal Zone Management (ICZM) and Integrated Coastal and Ocean Management (ICOM), underpinned by principles of ecosystem-based management, provide for the best chances of sustainable coastal and marine development. These multi-sector and multi-disciplinary management principles, integrate to the widest possible extent all relevant data and information into management, including crucial EO observation data and information where available.

Needs analyses of skills, knowledge, data, information and finances necessary for the sustainable management of marine and coastal zones have been undertaken by several agencies and projects in the region, such as:

- Transboundary Diagnostic Analyses (TDAs) and Strategic Action Programmes (SAPs) which have been carried out by all countries participating in African Large-Marine-Ecosystem Projects. TDAs and SAPs have all shown the need for earth observation products (services) to guide and inform management and policy
- ReCoMaP institutional and organisational Integrated Coastal Zone Management (ICZM) capacity assessments
- Joint Ocean Data and Information Management for Africa (ODINAFRICA)/Agulhas and Somali Current Large Marine Ecosystems (ASCLME) Project assessment of capacity for marine and coastal data and information management as well as capacity for long term ecosystem monitoring
- Assessment of national capacities for meteorological and oceanographic data collection and modelling by the Data Buoy Cooperation Panel (of JCOMM; the Joint Commission of the World Meteorological Organisation and the Intergovernmental Oceanographic Commission (IOC/UNESCO)
- IOC/UNESCO global capacity assessment (on-going)
- IOC-Africa Capacity Assessment for Marine Sciences (on-going)
- GOOS-AFRICA Satellite Remote Sensing Work package
- GOOS-AFRICA in situ observations and measurements work package
- UNESCO Crosscutting project on the Applications of Satellite Remote Sensing for Integrated Management of Ecosystems and Water Resources in Africa
- USGS /RCMRD capacity of the use of EO data
- RCMRD/NASA assessment of National capacities in the use of EO in five Eastern African countries (Servir-Africa)
- RCMRD capacity needs of geo-information of all its 18 member (on-going)
- ASCLME Project assessment of national and regional requirements for short and long term capacity building and training in the Western Indian Ocean region
- EC Europe Africa Marine EO Network analysis of EO and wider training needs (on-going)

- GMES and Africa Marine and Coastal Areas Workshop 1

Priorities for EO data collection include support for fisheries MCS (Marine Control & Surveillance) and other maritime surveillance, ocean state (sea surface temperature, salinity, currents), understanding anthropogenic pressures (population and land use information and data on change), support for management of the oil & gas sector, pollution management, support for aquaculture management, mapping of critical habitats (mangroves and coral reefs) as well as disaster management and assessment.

3. Stakeholders in GMES and Africa Services

Stakeholders in GMES and Africa services are institutions or organisations that support the production or user-uptake of EO services in Africa. A non-exhaustive list is presented in Annex I: Table 1. Understanding the stakeholder community and engaging key partners in the planning process is critical for the success of the GMES programme. Several agencies have expended considerable investment in EO activities to date, and would be important co-funders, data providers, or co-implementers of GMES and Africa services. Stakeholders also include users of EO raw data or data products; partners that would ensure the relevance and applicability of EO products for management and policy development. It will be essential to engage the whole continuum of stakeholders to ensure a relevant, practical and functional GMES and Africa service.

4. EO Projects and Programmes in Africa

The development and implementation of a GMES and Africa Programme and Services in Marine and Coastal Areas will build upon existing EO programmes, components and facilities, taking into account the current situation as well as current programming in international and bilateral development cooperation. Annex I, Table 2 shows a non-exhaustive listing of current EO projects, programmes and institutions to be considered. GMES and Africa will focus specifically on developing and consolidating regional programmes and services that cut across national boundaries while integrating already existing and planned country projects and programmes.

Many EO programmes and projects include strong capacity building components in the form of training courses regularly conducted in different places in Africa, or on-line tutoring addressing specific EO techniques and applications. Such continuous training is crucial to enable users to effectively exploit satellite data. Annex I: Table 2 also shows current and planned projects, programmes and institutions providing capacity building in EO of marine and coastal areas in Africa.

5. Specific Actions under the GMES Africa Service and Suggestions for Technical and Financial Support Instruments

5.1 Current Gaps and Needs

There are too few marine and coastal development programmes in some areas of Africa. There is a need for inter-connected programmes and projects, operating as an integrated operational Africa-wide framework. To support pan-African sustainable coastal and marine development, it will be crucial to establish new integrated initiatives, with coordinated regional and international technical and financial support involving the commitment of the entire international donor community. An example is the need for a pan-African network of coastal and marine observatories, gathering in situ measurements at appropriate geographic scales and management levels, forming an Africa-wide Integrated Coastal and Marine Zone Management Community.

Elements that need strengthening include:

- In situ measurements in their own right, and for ground-truthing to support accurate EO interpretation
- Effective dissemination of value added products, in near-real time, taking advantage of new and developing broadband links in Africa
- A strong capacity building and maintenance programme, building on existing capacities and training facilities

African marine and coastal management stakeholders have broadly identified needs for specific EO products in: maritime safety and security; ocean state, forecast and disaster warning; ecosystem assessment; anthropogenic impacts and coastal and marine resources management.

5.2 Existing and planned Programmes

The funding and decision making processes for the GMES and Africa Marine and Coastal services should be driven by public authorities, within a joint EU-African governance framework. This will contribute towards long term sustainability of the system. Annex I, Table 2 shows sources of potential financial support to the GMES and Africa Service including international organisations, contributions from the European Union (e.g. the geographical extension of the African Monitoring for the Environment and Sustainable Development project) and European Commission financial instruments, space agencies such as EuMetSat, African Regional Economic Communities and African financial instruments such as the African Development Bank.

The European Union provides funding opportunities relevant to research and applied research in connection with GMES and Africa, in particular, with respect to marine and coastal areas. Related funding programmes include EO opportunities announced by the European Space Agency and by EuMetSat. Other opportunities are described in the context of initiatives under GEOSS, whilst regional funding opportunities may arise as part of the Pan African Large Marine Ecosystems, funded through the Global Environment Facility. All initiatives and programmes that were, or are still today funded under these initiatives have a strong capacity development and maintenance emphasis, entirely appropriate for empowerment within GMES and Africa in the marine and coastal areas of Africa.

Exemplary programmes include:

1. With the success of the African Monitoring of the Environment for Sustainable Development Project (AMESD), the European and African Union have now agreed to extend the development and application of EO services in Africa through the 2013-18 Monitoring of Environment and Security Project (MESA) implemented by AUC and African RECs. The Coastal and Marine environment theme will be replicated for the whole western African region with a new Regional Implementing centre. With AMESD assistance two operational EO services were already developed: a. A service to detect potential fishing zone for fisheries management and fishing activities, and b. A service for climate change monitoring & marine hazard mitigation. It is thus obvious that future MESA activities should be employed to support and assist in the development and implementation of the envisioned GMES & Africa Services.
2. The Europe-Africa Marine EO Network (EAMNet) is constructing a network linking Earth Observation (EO) information providers, user networks and centres of excellence in Europe and Africa in the area of coastal and marine observations towards sustainable development in Africa, and the DevCoCast programme that provided infrastructure support for satellite transmission of EO products, extending GEOSS GEONETCast across the countries of Africa, funded through the European Union International Cooperation.
3. The Agulhas and Somali Current Large Marine Ecosystems (ASCLME) Project funded by the GEF and implemented by the UNDP, has been instrumental in planning and implementing a western Indian Ocean-wide long term monitoring programme for coastal and marine ecosystems of the region. Together with participating countries and international partners such as NOAA, NIOZ, IRD, ACEP, and BCRE, and networks such as WIOMSA, IOGOOS and GOOS-AFRICA, the ASCLME Project has supported in-situ data collection, earth observation, as well as the development of spatial and model products for coastal and marine management. Earth Observation activities will continue and be expanded in strategic areas over the next five years as agreed by nine countries of the region, which would be useful in the support of GMES & Africa Services.
4. OceanSAfrica is an integrated network for ocean observation and modelling in southern Africa, made up of four components, i) in-situ ocean observation (DEA and BCRE), ii) EO (CSIR and MRSU), iii) Data description and metadata management (SAEON), and iv) modelling (UCT). Having established platforms for components of EO in the southern African region (associated with the LMEs), OceanSAfrica is well placed to support GMES & Africa Services.
5. The African Marine and Coastal Atlas, developed by 16 African states with support from the ODINAFRICA Project of the IOC/UNESCO has developed an online resource of delayed-mode spatial data products derived from in-situ and EO data sources. The atlas has established nodes at continental, LME and national scale, and has an active capacity building and training component.
6. The GOOS-AFRICA programme is the Global Ocean Observing System in Africa with a multi-modular approach integrating 6 inter-related components/work packages such as: (i) Network of in situ observations and measurements stations along African coast, (ii) Network of satellite remote sensing centres in Africa, (iii) coastal and ocean modelling, data assimilation and forecasting, (iv) End-to-end communications and information delivery, (v) Strategic Business and Industry Partnerships, (vi) Project management integration and coordination.

6. Building the GMES and Africa Service

6.1 Service Definition and Provision:

The six European GMES core services address atmosphere monitoring, land monitoring, marine environment monitoring, emergency management, security and climate change monitoring in support of adaptation and mitigation policies. These services, and in particular the marine environmental monitoring service, which will be part of the specific GMES & Africa Services, will provide data and information addressing environmental, socio-economic and development issues of critical importance to African coastal states such as:

- Integrated Coastal Zone Management and Integrated Coastal and Ocean Management,
- Conserving marine and coastal biodiversity,
- Sustainable management of coastal and marine natural resources and environmental services,
- Building climate change resilience, adaptation and mitigation,
- Protection against natural and human-induced disasters,
- Sustainable fisheries management (including MCS),
- Managing coastal population growth and its environmental and socio-economic effects,
- Understanding and addressing continental and SIDS specific marine and coastal environmental and development issues,
- Understanding and managing environmental health issues,
- Understanding and predicting natural variability in ocean state and weather,
- Safeguarding and managing coastal freshwater resources.

It will be important to encourage the use of Best Practice and the creation of stakeholder networks in marine and coastal integrated management for the sustainable benefit of all groups of society. This can be accomplished by implementing operational, integrated services, built on existing programmes, and available throughout Africa.

6.2 Capacity Building and Maintenance

Necessary Elements: Institutions, Human Capacity and Skills Training

In Africa, considerable differences prevail in EO capacities for coastal and marine management, with some countries already utilising EO-based systems, while most countries have very little or rudimentary capacities, some having been built with project support. Without addressing these gaps, the continent will fall further behind in its ability to respond to the challenges of establishing sustainable coastal and marine management. While supporting the development of necessary skills with the EO data user groups involved in coastal and marine management, it will be equally important to support investments into infrastructure specific to EO applications in coastal and marine management within relevant institutions across the continent. African academic and research institutions should be empowered to play a vital role for sustained self-running capacity building.

Strategy to develop the necessary elements

Capacity building must take on an “operational” profile, enabling nations to manage the marine and coastal services required by society, maintaining vital links to science, technical infrastructure and international cooperation. It must be based on identified priorities as well as on utilising shared observations and data resources, and shared technical and scientific service tools. Not all of these conditions are adequately met today. However, from experience with existing services, the availability of data and sophisticated numerical models and the expanding use of IT should be accelerating the implementation of marine and coastal EO systems.

Capacity building activities must find a balance between front-running high technology, and the realism needed for robust and sustained systems in the African context. The aim must be to make nations optimally self-sufficient in using marine and coastal observing systems. Full use should be made of support for capacity development in Africa provided by the programmes sponsored by the European Union and the Group on Earth Observations. It will be necessary to form strong links in an Africa-wide network, comprising such elements as, regional maritime industries, local and federal governments and their coastal and marine research institutions, Regional Economic Commissions, and Non-Governmental Organisations (NGOs). Professionally trained and empowered scientific, technical and management staff, specifically involved in coastal and marine management will be needed to generate, disseminate and utilise marine and coastal EO

products of value to the people of Africa. It is critically important for governance capacity to be improved, which requires improved mechanisms of exchange and communication between science/observation and management/policy development.

6.3 Prioritisation of Requirements and Actions

The Proposed GMES Africa Service for Marine and Coastal Areas

The GMES and Africa Service for Marine and Coastal Areas will be an operational, integrated service, building on existing programmes, and available throughout Africa. The structure of this Service will be founded on the following components:

An Africa Network of Modelling and Forecasting Centres

A major need exists for specific value-added EO products to support African coastal and marine user communities. A network of centres would enable the exchange of information and expertise, the development of consistent products, and the efficient dissemination of information using the same (or interoperable) protocols.

EO products of particular relevance include:

- **Operational coastal sea level, coastal circulation and coastal sea state data, analyses, imagery and mapping**, downscaled to the particular coastal and marine management unit at hand. This product should be in a user-friendly format, having been interpreted for the relevant user communities: coastal flooding and coastal erosion events for planners and coastal managers, and coastal circulation, for example, for offshore oil and gas industry, ports, shipping and for safety at sea, identification of potential fishing grounds/ zones.
- **Operational biological productivity data, analyses, imagery and mapping**, biodiversity, coverage, Chlorophyll, low oxygen and harmful algal blooms as part of ecosystem health reporting from Long Term Ecosystem Research (LTER) observational networks.
- **Coastal sensitivity and vulnerability atlases** and **state of environment reporting** for coastal and marine managers, coastal land use planners, city managers, and the private sector (i.e. tourism industry, fishery, oil & gas, etc.), near-shore and off-shore.
- **Ship traffic situation and maps.** The real-time view of the ship traffic is needed for operational actions in e.g. fisheries and pollution control and maritime safety and security. Historic patterns of ship traffic, by ship type, season, time of day, etc., are needed for long-term management.
- **Regional weather forecast systems** (5 to 7-day horizon).
- **Real-time Disaster Warning Systems.**

Offshore industries, such as oil and gas producers, often require detailed products based on very specific observations, to help in ensuring safe operations in a hostile marine environment. These products could be of interest to multiple user communities. The tourism industry for example, can make immediate use of many of the products generated for users in the public sector. The GMES and Africa Network of Modelling and Forecasting Centres would rely on other operational facilities providing relevant observations, archives of historic data, powerful computer platforms and the means to disseminate the products in an effective manner.

Modelling and Forecasting Centres and the Remote Sensing Centres may be combined in the same institution depending on competencies.

A GMES and Africa Network of Marine Remote Sensing Centres

These regional centres would be the fully operational successors to various existing pilot facilities such as *www.amis.jrc.ec.europa.eu, www.eamnet.eu, www.rsmarinesa.org.za, www.africanmarineatlas.org* which currently already provide maps and statistics of various parameters at continental scale and for selected regions. The development of new satellite products at an operational level, for example ocean colour products for coastal, marine and ocean management purposes, would be initiated and would be closely linked to the new generation of satellites from space agencies, including EuMetSat and ESA. These centres would form an African Marine Remote Sensing Core Service, operating under the auspices of GMES and Africa. Satellite imagery is essential to monitor ship traffic that cannot be

tracked with coastal sensors or with the established ship reporting systems, providing a cost-effective alternative or complement to patrol assets.

A GMES and Africa Network of Coastal Observatories

These coastal observatories will be established at key locations along the coasts and seas of Africa, and would be responsible for collecting in situ observations. Mega cities, ports, areas with offshore industrial activity and sites of particular significance for ocean/atmosphere monitoring and forecasting are examples of priority locations.

Measurements from these stations would be of value in their own right, and they would also provide ground truth data in support of the increased application and quality assurance of satellite observations in coastal and marine areas not only in Africa but at a global scale. The network would build on existing national monitoring programmes, the long term monitoring programmes of the regional LME Projects, existing networks and GOOS-AFRICA/ IOGOOS components, such as the near-real time sea level observations from the African sector of the GLOSS network, the Research Moored Array for African-Asian-Australian Monsoon Analysis and prediction (RAMA), the African Monsoon Multidisciplinary Analysis (AMMA) and national networks such as the Seychelles Ocean Temperature Network. However, the coastal observatories will also add key elements to the existing suite of observations, operating under common objectives using standardised observational tools and infrastructure, and with common ground and satellite links. Regional needs will influence the priorities under which the various stations will develop their capabilities. Benefits of an integrated network include consistent and standardised data collection, standard data exchange protocols, better uptake of data across platforms and for different purposes, and better coverage at continental scale.

To monitor coastal ship traffic, a chain of coastal AIS receivers (low cost, so entirely possible) and ideally also radars is needed. These can be integrated into a coastal VTS (Vessel Traffic System) or with existing port VTS systems. Fishing, also further away from the coast, should be monitored with national or regional VMS (Vessel Monitoring System, fishing ship reporting system). The LRIT ship reporting system enables the tracking of the larger merchant ships over the seas. Integration of these data sources, enriched with satellite observations, provides a powerful tool for maritime awareness, which is essential to protect the seas in the region.

A GMES and Africa Capacity Development Network of Higher Education Institutions

This Network will be the final link in the chain of networks proposed for GMES and Africa. The priorities within this Capacity Development Network should not only be the building of new capacity in Africa, but also the effective utilisation and maintenance of existing capacity. The Network of Higher Educational Institutions should form strong links to regional maritime industries, to local and federal governments and their coastal and marine research institutions, to regional geo-information centres such as RECTAS, RCMRD, CRASTE-LF, to the Regional Economic Commissions, as well as to existing capacity building projects and programmes (Annex I: Table 2 contains a list of relevant projects and stakeholders).

Considerable benefit would materialise from such a network which would see centres of excellence established by institutions with competence in different fields. Information could be exchanged on best-approaches for tackling transboundary issues, and joint strategies for training and collaboration could be developed. Experts could be shared across the African region which would in itself assist to build and retain African capacity. The existence of a network would rationalise the cost of data and image processing, and would facilitate the validation and verification of data quality.

Cross-cutting issues

Supporting technical platforms will be needed to ensure that the GMES and Africa Service can operate effectively. A Data Management Platform will be needed for quality control of all observational data, for archiving and retrieving historic data, and for the generation of climatologies to add value to the data. A Marine and Coastal Modelling Platform will be needed to house the computing power and modelling software for the development of (prognostic) dynamic models and (diagnostic) empirical-statistical models for effective forecasting products. Extensive capacity building will be needed to ensure that these Platforms are utilised effectively.

A rapid uptake of the advantages of new communication technology, for example making use of the various new fibre optics cables of the Africa ICT Information highways currently installed, will be needed. Such ICT initiatives increasing bandwidth across and around Africa provide new opportunities to ensure speedy dissemination of value added EO products.

The African component of the recently completed DevCoCast project and the on-going EAMNet project are important initiatives to help in the distribution of various marine remote sensing products across Africa. For example, chlorophyll products derived from ocean colour data are being used to demonstrate its effectiveness (through the Chlorophyll Global Integrated Network and in support of AMESD in the western Indian Ocean). Both these projects illustrate the value of cooperation between Europe and Africa. Within GMES and Africa, it will be important to prioritise the extension of DevCoCast and EAMNet into fully operational mode.

How Can GMES and Africa Be Made More Effective?

Regional Centres as Focal Points of Networks

Regional Centres should be developed within each region of Africa in order to provide the GMES and Africa Service to all the countries of the region. A suggestion would be to create these Centres in association with the African Large Marine Ecosystems.

- **Southern Africa**: Temperate coastal areas subject to extreme weather events from the sea. Maritime industries, such as fisheries and diamond mining, and regional trade and shipping form important contributions to the economies of this region.
- **East Africa and the Western Indian Ocean Islands:** The Agulhas and Somali Current LME region is active in ensuring the long term sustainability of its marine resources. Coral and mangrove ecosystems with associated fisheries, and the coastal tourism industry, are important in this region. Ocean-atmosphere interactions drive seasonal monsoons which have a significant effect on ecological processes, and the region is prone to extreme weather events such as tropical cyclones.
- **Tropical West Africa:** The Guinea Current LME is active in the 16 coastal countries of this region. Mega cities in an increasingly populated coastal zone, vulnerable to the impacts of global change, are a critical challenge. The dominant contribution to the economies of countries from Ghana to Angola is the production of oil and gas from the offshore oil fields.
- **North-West Africa:** The Canary Current LME with coastal fisheries and offshore mining industries.
- **North Africa/Mediterranean:** These countries from Morocco to Egypt are part of the Mediterranean LME.
- **Red Sea:** The African countries of the Red Sea are part of the Red Sea LME region.

Build and Strengthen Flagship Programmes

Key programmes, covering specific segments of EO and a GMES and Africa Service should be established or consolidated from existing international networks (see Annexes I and II). In cooperation with, and possibly associated with the existing Regional Environmental Centres, these programmes could be conceptualised to support cross border and regional cooperation, which would be further developed into a full module/ segment of the GMES and Africa Service and Network. Institutions with key competencies or mandates should be developed into regional centres of excellence to provide elements of support or training as part of the wider programme.

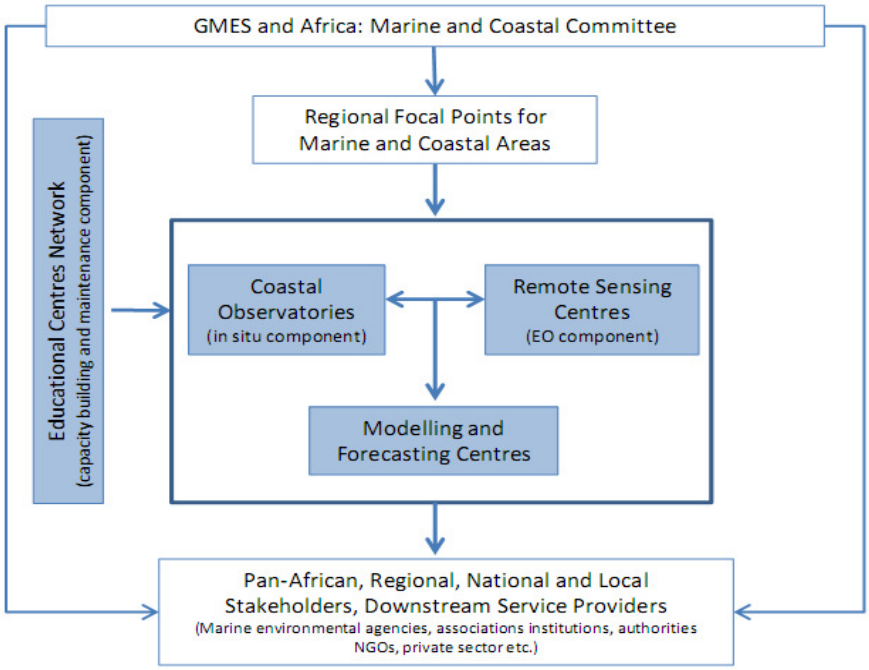
For instance, ChloroGIN is already providing a focal point for development of international collaboration, networking and capacity building. ChloroGIN partners from Africa and Europe are participating in the (now completed) EC DevCoCast (GEONETCast applications for and by developing countries) and on-going EAMNet projects, which use the GEONETCast concept to provide satellite data on chlorophyll-a, ocean colour and SST from MODIS, AVHRR and MERIS from regional data providers in South Africa and Europe to countries in Africa (Namibia, Tanzania, Ghana and Senegal). EAMNet has also improved the technical infrastructure by installing a number of GEONETCast receivers at marine science institutes. As these projects develop it is hoped that additional partners and countries will join in. It is also expected that additional products will be provided to the international user community.

6.4 Organisational Scheme

Effective and sustainable coastal and marine management in Africa can only exist under predictable, efficient, and accountable governance systems. The GMES and Africa Service for Marine and Coastal Areas is no exception and should be designed in such a way that continuous user uptake is possible following comprehensive stakeholder consultations.

The system should allow integration of changing stakeholder needs in an iterative process. Four components are proposed for the GMES and Africa Service for Marine and Coastal Areas illustrated in Figure 1.

Figure 1. Organisational scheme of the GMES and Africa Service for Marine and Coastal Areas



Each of the four components should have its own characteristics in terms of ownership, facilities, decision-making process and management.

In addition, an overall management structure established under the auspices of the African Union would facilitate continued consultation with the coastal and marine user community, ensuring the updating of current issues leading to information needs for management. It would thus also determine priorities and distribute resources between all the service components accordingly.

7. Summary and Recommendations for Short, Mid and Long Term Activities

The European Union and the African Union wish to deepen the dialogue and cooperation between African coastal and marine policy makers and managers and the existing Global Monitoring for Environment and Security (GMES) Programme and European and African policy makers, to ensure GMES Services remain relevant to the countries of Africa.

Africans, like people in other developing parts of the world, are increasingly migrating to the coast to find better living conditions, chances for personal development, and many times, to escape poverty. This migration is putting severe pressure on coastal and marine environmental and ecosystem services and resources. A high proportion of the GDP of Africa is produced along the coastlines and within the EEZ. Coastal cities are growing dramatically, raising issues of, among others, environmental health standards, adequate to ensure the well-being of their often poor inhabitants. The regional marine and coastal Conventions of Abidjan, Nairobi, Jeddah and Barcelona, in conjunction with the United Nations Conference on Environment and Development, steered by the Declarations from the World Summits on Sustainable Development, are setting the stage for sustainable coastal and marine development around Africa. They also provide the policy drivers for joint action by the countries of Africa.

The extension to Africa of the European GMES Programme, with its reliable information services, will greatly support the countries of Africa in their quest for safe and sustainable coastal and marine development. Existing initiatives specifically addressing African coastal and marine zones as well as already existing global initiatives with applications around Africa will be used as the foundation for building a full GMES and Africa Service in Marine and Coastal Areas. Sectors which will benefit from such a GMES and Africa Service are, among others, integrated coastal zone planning and management, the coastal urban management, coastal and marine protected areas, fishery management, offshore industries such as oil, gas and mining, general coastal and marine environmental management and the management of the large African Marine Ecosystems (LME). The proposed GMES and Africa Service will be associated with continued and intensified capacity building of all core stakeholder and user groups of its products, including institutional and organisational strengthening and support to the establishment of responsible institutions and organisations where necessary. Various international, regional and national funding instruments will be accessed and utilised.

From existing initiatives, it is possible to identify priorities, gaps and needs where capacity building and maintenance and new investment are sorely needed. In a broader sense, the crucial priority is for operational programmes in the marine

and coastal areas of Africa, which routinely bring information and products of value to policy makers in the user community. To rectify this, Africa needs a **GMES and Africa Service for Marine and Coastal Areas** that should be:

- Pan African: reaching to all the coastal countries of Africa;
- Operational: utilising Earth Observation from space agencies;
- Comprehensive: an end-to-end service from observations, through analysis and forecasts, to the dissemination of value-added products;
- Built on existing research projects and pilot programmes;
- Maintained and operated by Africans, developing and utilizing African capacity in African Centres of Excellence;
- Demonstrably useful for marine and coastal managers and policy makers to maintain sustainability of marine living resources;
- Feed into local and national governance schemes that ensure effective consultation with all stakeholders;
- Equipped with a continuous funding processes and sustainable budgeting so as to maintain long-term sustainability of the Service.

Priority Activities are sorted according to term (ST-short/MT-medium/LT-long) under each of the three GMES and Africa Service components. Some of the activities will require international cooperation and technical and/or financial support.

1. A Network of Modelling and Forecasting Centres

1.1 Review the competencies of existing African and global modelling and forecasting centres (including GMES activities in Europe relevant to Africa)and centres of excellence (ST)

- Actors: Scientific Committee with IOC/UNESCO, regional/national experts and LME Projects
- Deadline: Month 12

1.2 Identify organisations that could provide technical support, e.g. HRST/AUC, ODINAFRICA, IOC/UNESCO;, GOOS-AFRICA, WMO, FAO, UNEP (ST)

- Actors: EU, AU, Scientific Committee with IOC/UNESCO, regional/national experts and LME Projects
- Deadline: Month 12

1.3 Integrated methods for EO and modelling need to be established regionally according to the issues identified by African participants (fisheries and ecosystems / coral reefs / coastal erosion / sea state monitoring) (MT-LT)

- Actors: Scientific Committee, IOC/UNESCO, WMO, FAO, UNEP, LME Projects, national departments
- Deadline: Month 24

2. A Network of Marine Remote Sensing Centres

2.1 Existing competencies of remote sensing centres including those involved in MESA and EAMNet should be reviewed. (ST)

- Actors: Scientific Committee with IOC/UNESCO, GOOS-AFRICA, FETREMSENS, UNESCO cross-cutting Remote Sensing project and LME Projects
- Deadline: Month 12

2.2 Integrated training across countries, relying on identifiable key competencies to be supported (i.e. MSc level at Universities in Réunion and Madagascar, the EAMNet EO module implemented in Ghana, Tanzania and South Africa, UNESCO Chairs in Benin, Senegal and Mozambique).

- Actors: EAMNet, IOC/UNESCO, EU/JRC, Scientific Committee, LME Projects, national universities and training facilities
- Deadline: Month 12 for planning; month 24 for implementation

3. A Network of Coastal Observatories

3.1 Existing coastal and marine observation networks should be assessed (in cooperation with GOOS-AFRICA, the LME projects and national line departments). (ST)

- Actors: GOOS-AFRICA, IOC/UNESCO, LME Projects, UNEP, HRST/AUC, national line departments

- Deadline: Month 15

3.2 Key priorities and gaps in in-situ observations should be identified and a comprehensive plan established to address these requirements - for in-situ observations in their own right, as well as for RS and model validation. There should be a strategy to involve the private sector. (ST-MT)
- Actors: GOOS-AFRICA, IOC/UNESCO, LME Projects, national line departments, private sector
- Deadline: Month 15

3.3 Regional coastal observatories should be established based on the Large Marine Ecosystems. (MT-LT)
- Actors: LME Projects, GOOS-AFRICA, national line departments, private sector
- Deadline: Month 24

3.4 Strengthen and expand the monitoring of critical habitats – including reefs, mangroves, seagrass beds, soft-bottom habitats and sandy beaches depending on regional priorities (such as coral reefs in East Africa). (IUCN and LMEs partners). (MT)
- Actors: UNEP, FAO, LME Projects, NGOs, national line departments
- Deadline: Month 24

3.5 Strengthen/establish vessel monitoring systems to assist MCS (IOTC, EU, SIDA, SMARTFISH partners). (MT-LT)
- Actors: AUC, IOTC, EU, SIDA, SMARTFISH, SWIOFC, LME Projects, IMO, FAO, IOC
- Deadline: 12 Months to develop a strategy, 16 months to commence implementation

4. A Network of Higher Education Institutions

4.1 Design and implement a capacity building/retention programme and on the activities of regional partners. This could be based on the existing EAMNet review of needs and the draft roadmap produced (ST-LT)
- EAMNet, IOC/UNESCO, UNESCO/HED, HRST/AUC, EU/JRC, Scientific Committee, LME Projects, GOOS-AFRICA, regional training centres, national universities and training facilities
- Deadline: Initial assessments consolidated by 9 months, implementation by 12 months

5. Cross-cutting Actions

5.1 Communicate information about GMES & Africa to all stakeholders including economic commissions and member states (via the AUC). (ST)
- Actors: AU, EU, IOC, LME Projects, UNEP
- Deadline: Immediate and on-going; communication strategy finalised by month 6

5.2 The African Marine and Coastal Atlas, supported by ODINAFRICA of the IOC/UNESCO should be supported for additional functionality to organise and disseminate data and metadata from GMES services. (ST-MT)
- Actors: IOC/UNESCO (ODINAFRICA), LME Projects, national departments
- Deadline: 15 Months to implementation

5.3 Support all stakeholders including economic commissions and member states in the application of GMES & Africa Services to Integrated Coastal Zone Management. (ST-MT-LT)
- Actors: RECs, RFMOs, LME Projects, national departments, NGOs and other stakeholders
- Deadline: Strategy development by month 12; implementation thereafter

5.4 The Applications of Remote Sensing for Integrated Management of Ecosystems and Water Resources in Africa, sponsored by UNESCO should be supported for further extension to all African coastal countries (ST-LT)
- Actors: UNESCO/HED, IOC/UNESCO, GOOS-AFRICA, regional geo-information centres and national universities
- Deadline: From day 1 of the GMES & Africa to full implementation

5.5 The UNESCO Chairs in marine sciences and oceanography, small coastal islands and geo-information should be supported as vital vehicle for capacity building. (ST-LT)
- Actors: UNESCO/HED, IOC/UNESCO, GOOS-AFRICA, regional and national training centres.

- Deadline: From day 1 of the GMES & AFRICA to full implementation.

5.6 Strategies for long term financial and technical support must be established. (ST-MT-LT)

- Actors: AU, EU, UN agencies, GEF, LME Projects, Scientific Committee, international partners and donors
- Deadline: Strategy established by 15 months and updated annually

Supporting platforms will be needed in data management, high speed computing, and new communication technology and communication links associated with these. As data is collected, processed and used in distributed places, and since data quantities are significant, good broadband connections are essential. Services will be delivered with web-based technologies, making internet the backbone of all networks and cooperation. The quality of these platforms will derive from and be based on existing and newly established Centres of Excellence and the further development of Earth Observation Flagship Programmes such as AMESD/MESA, ChloroGIN Africa, EAMNet, DevCoCast Africa and the African Marine and Coastal Atlas.

The successful implementation of the GMES and Africa Service for Marine and Coastal Areas will be a key contributor to sustainable development for the people of Africa, and will be a worthy endeavour by the European Union and the African Union. One key to its long term viability will be the provision of adequate capacity in personnel and infrastructure within its institutions and programmes, addressing the real development priorities in the coastal and marine areas of Africa within a coordinated scientific and user framework of coastal and marine policy and decision makers and managers, The other requirement will be a stable level of financial support into the future.

Annex I: Tables

Table 1: Current (2012) regional and bilateral EO Projects and Programmes specifically or partially covering marine and coastal areas in Africa (CB = Capacity building component)

Marine and Coastal Programmes		Supporting Institutions	EO CB	
ACCC-Africa	Adaptation to Climate and Coastal Change in West Africa	GEF/UNDP		**www.accc-afr.net**
ACCESS	Applied Centre for Climate and Earth System Science	UCT, Princeton Univ., Third World Academy of Science (Trieste)	yes	**www.access.ac.za**
AMA	African Marine and Coastal Atlas for coastal resource managers	FUST/IOC-UNESCO	yes	**www.africanmarineatlas.net**
AMESD	African Monitoring of the Environment for Sustainable Development (2007-2012)	EU/COI/IGAD/AU	yes	**www.amesd.org**
Coast-Map-IO	Improving Emergency Response to Ocean-based Extreme Events through Coastal Mapping Capacity Building in the Indian Ocean (completed)	IOC-UNESCO	yes	**www.ioc-cd.org**
CORDIO	Coastal Oceans Research and Development in the Indian Ocean	IUCN, WIOMSA, World Bank, FAO		**www.cordioea.org**
DBCP	Data Buoy Cooperation Panel	JCOMM (WMO, IOC/UNESCO)	yes	**www.jcommops.org/dbcp**
GGMCRP	Gulf of Gabes Marine and Coastal Resources Protection project	GEF		**www.thegef.org/gef/project_detail?projID=1174**
ISLANDS (ISIDSMS)	Implementing the SIDS Mauritius Strategy (2011-2013)	COI/EU		
MESA	Monitoring for Environment and Security in Africa (2013-2017)	EU/AUC; RECs & RICs	yes	
NASRP	IUCN North Africa Sub-Regional programme	IUCN		**www.iucn.org**
NC-CHM	Nairobi Convention Clearing House Mechanism	UNEP	yes	**www.unep.org**
RCMP	Regional Coastal and Marine Conservation Programme for West Africa	WWF/IUCN		
ReCoMaP	Regional Programme for the Sustainable Management of the Coastal Zones of the Indian Ocean Countries (2007-2011)	COI/EU	yes	**www.progeco-oi.org**
WIO-LaB	Addressing land-based activities in the Western Indian Ocean (2006-2009)	GEF/UNEP		**www.wiolab.org**
	Marine Protected Areas			
FAO	Process for the identification of Vulnerable Marine Ecosystems (VMEs)	FAO		
RAMP-COI	Marine Protected Areas of the Indian Ocean Commission	WWF/COI		**www.ramp-oi.org**
TRANSMAP	Transboundary networks of marine protected areas in East Africa	EU		**www.transmap.fc.pt**
WWF-EAME	East African Marine Ecoregion	WWF		
	Pollution			
PUMPSEA	Peri-urban mangrove forests as filters of domestic sewage in East Africa	EU		**www.pumpsea.icat.fc.pt**
WIO Marine Highway	Western Indian Ocean Marine Highway Development and Coastal and Marine Contamination Prevention Project	GEF/WB/COI		**www.iwlearn.net**

Marine and Coastal Programmes		Supporting Institutions	EO CB	
	Large Marine Ecosystems			
ASCLME	Agulhas and Somali Current Large Marine Ecosystems Project	GEF/UNDP	yes	**www.asclme.org**
BCLME	Benguela Current Large Marine Ecosystem			**www.bclme.org**
CCLME	Canary Current Large Marine Ecosystem Project			
GCLME	Guinea Current Large Marine Ecosystem	GEF/UNDP		**www.gclme.org**
SPMLME	Strategic Partnership for the Mediterranean Large marine Ecosystem	GEF/UNEP		**www.medsp.org**
SWIOFP	South West Indian Ocean Fisheries Project	GEF/WB		**www.swiofp.org**
WIO-Lab	Addressing Land Based Sources of Pollution in the WIO	GEF/UNEP		
	Remote Sensing Servers and Centres			
CERGIS	Centre for Remote Sensing & Geographical Information, University of Ghana		yes	
CRTEAN	Centre Régional de Télédétection des Etats de l'Afrique du Nord (North African Centre for Remote Sensing)		yes	
GMIS	Global Marine Information System (specific focus on Africa, Caribbean and Pacific countries)	EU-JRC	yes	**www.amis.jrc.ec.europa.eu**
MyOcean	EC FP7 MyOcean project	EC		**www.myocean.eu.org**
NEODAAS	NERC Earth Observation Data Acquisition and Analysis Service	NERC		**www.neodaas.ac.uk**
RCMRD	Regional Center for Mapping of Resources for Development	UNECA		
RECTAS	Regional Centre for training in Aerospace Surveys	UNECA	yes	**www.rectas.org**
RSSMS	Remote Sensing Server for Marine Sciences in Africa	DST-SA	yes	**www.afro-sea.org.za**
SAEON	South African Environmental Observation Network	NRF-SA		**www.saeon.ac.za**
UCT Ma-Re	University of Cape Town Marine Research Institute	UCT	yes	**http://ma-re.uct.ac.za/**
University of Abomey-Calavi (Benin)	International Chair of Mathematical Physics and Applications. University	UNESCO/SC, IOC-UNESCO UPS (France) IRD (France)	yes	**www.cipma.net**
	Observation Networks **Dedicated capacity building programmes**			
Argo Project	Argo Project	NOAA, ASCLME…		**www.argo.net**
CFOO	Centre for in-situ observational oceanography for southern Africa and the WIO region.	UCT, ASCLME, DEA, BCRE, NRF-SA, CSIR		**www.cfoo.co.za**
ChloroGIN - Africa	Chlorophyll Global Integrated Network in Africa	GEO	yes	**www.chlorogin.org**
CORDIO	CORDIO Coral bleaching forecast/early warning system	WIOMSA, IUCN		**www.cordio.org**
DevCoCast	GEONETCast for developing countries	EU	yes	**www.devcocast.eu**
EAMNet	Europe – Africa Marine EO Network (2010-2013)	EU	yes	**www.eamnet.eu**
Global Drifter Programme	South African Environmental Observation Network	SA- DST		
GLOSS	African sea level network	FUST/IOC-UNESCO		**www.gloss-sealevel.org** **www.sealevelstation.net**
GOOS-AFRICA	Global Ocean Observing System (GOOS Africa, IO GOOS and subsidiaries)	IOC/UNESCO, African Countries		**http://ioc.unesco.org/goos/Africa/GOOS-AFRICA.htm**
IOC-CD-WIO	Capacity Development Programme for the Western Indian Ocean	IOC-UNESCO	yes	**www.ioc-cd.org**
LOCO	Long-term Ocean Climate Observations	NIOZ, KNMI, Utrecht		

Marine and Coastal Programmes		Supporting Institutions	EO CB	
		University, ASCLME		
Ocean Teacher	A training resource for Oceanography and Marine Meteorology	IOC-UNESCO	yes	**www.oceanteacher.org**
OceanSAfrica	Integrated network for ocean observation and modelling in southern Africa	CSIR, UCT, DEA, SAEON		
OceanSITES	Network of global in-situ reference stations (surface to deep-water data collection)			**www.oceansites.org**
ODINAFRICA	Global sea level observing system in Africa	IOC-UNESCO	yes	**www.odinafrica.org**
PMAR	Piracy, Maritime Awareness and Risks	EC-JRC	yes	**https://bluehub.jrc.ec.europa.eu/**
RAMA	Research moored Array for African-Asian-Australian Monsoon Analysis and prediction	NOAA, ASCLME		
SIMORC	System of Industry Metocean data for the offshore and Research Communities	OGP		**www.simorc.org**

Table 2: National, regional and national sources of potential financial support to the GMES and Africa Service Potential Funding Sources and Donors

Organisation		Coverage
COI	Indian Ocean Commission	Regional
COMESA	Common Market for Eastern and Southern Africa	Regional
DST-SA	South African Department of Science and Technology	National
EC	European Commission	Global
ECCAS	Economic Community of Central African States	Regional
ECOWAS	Economic Community of West African States	Regional
FUST	Flanders UNESCO Trust Fund	Regional
GEF	Global Environment Facility	Global
GEO	Group on Earth Observations	Global
IMO	International Maritime Organisation	Global
IOC-UNESCO	Intergovernmental Oceanographic Commission of UNESCO	Global
IUCN	World Conservation Union	Global
NERC	Natural Environment Research Council of the United Kingdom	National
OGP	Association of Oil and Gas Producers	Global
SADC	Southern African Development Community	Regional
UMA	Union du Maghreb Arabe	Regional
UNDP	United Nations Development Programme	Global
UNEP	United Nations Environment Programme	Global
WB	World Bank	Global
WIOMSA	Western Indian Ocean Marine Science Association	Regional
WWF	World Wildlife Fund	Global

Annex II. Policy Drivers

Over recent decades, several Multilateral Environmental Agreements (MEA) have been enacted, all of which are particularly relevant to Africa's development needs. These MEAs at global scale were complemented by regional MEAs in Africa that were able to address local issues and priorities more specifically. GMES and Africa will be at the forefront of providing the means through which many of the objectives of these international and regional MEAs can be achieved and from which sustainable Africa-wide development will benefit.

International Conventions of Relevance to the Development of Africa's Coasts

- The United Nations Convention on the Law of the Sea (1982) set down the rights and duties of coastal nations within their Exclusive Economic Zones.
- The United Nations Conference on Environment and Development, UNCED Rio de Janeiro, June 1992 led to the formation of the various Global Observing System initiatives, for the land, ocean and for climate, to the formation of the Alliance of Small Island Developing States, and to the United Nations Convention on Biological Diversity committed to the establishment of marine protected areas.
- The World Summit on Sustainable Development (WSSD Johannesburg 2002) sought to protect and manage the natural resource base of economic and social development.
- The WSSD also provided the platform for the Group on Earth Observations (GEO) to establish its Global Earth Observation System of Systems (GEOSS), which is addressing nine societal benefit areas (SBAs) of critical importance to people and society. It aims to empower the international community to protect itself against natural and human-induced disasters, understand the environmental sources of health hazards, manage energy resources, respond to climate change and its impacts, safeguard water resources, improve weather forecasts, manage ecosystems, promote sustainable agriculture and conserve biodiversity.
- The United Nations Conference on Sustainable Development – UNCSD (also known as Rio+20) held in Rio de Janeiro, Brazil, in June 2012 renewed the commitment of governments to sustainable development, and to ensuring the promotion of economically, socially and environmentally sustainable future for our planet and for the present and future generations.
- The UNCSD outcomes document - "Future We Want" recognised the importance of space-technology-based data, in situ monitoring, and reliable geospatial information for sustainable development policy making, programming and project operations. In this context, UNCSD noted the relevance of global mapping and recognized the efforts in developing global environmental observing systems, including by the Eye on Earth network and through the Global Earth Observation System of Systems. UNCSD recognized the need to support developing countries in their efforts to collect environmental data.
- The "Oceans Compact: Healthy Oceans for Prosperity", launched by the United Nations Secretary General in August 2012 sets out a strategic vision for the UN system to deliver on its ocean-related mandates, consistent with the Rio+20 outcome document "The Future we Want" in a more coherent and effective manner. It aims to provide a platform for all stakeholders to collaborate and accelerate progress in the achievement of the common goal of "Healthy Oceans for Prosperity. Three inter-related advance this goals: (i) Protecting people and improving the health of the oceans; (ii) Protecting, recovering and sustaining the oceans' environment and natural resources and restoring their full food production and livelihoods services; and (iii) Strengthening ocean knowledge and the management of ocean. These objectives must be underpinned by a robust global ocean observation and knowledge infrastructure and the successful operation of the UN General Assembly's Regular Process.
- The United Nations Framework Convention on Climate Change (UNFCCC)
- The United Nations Convention to Combat Desertification (UNCCD)
- The Convention on Biological Diversity (CBD)
- The United Nations Programme of Action on the Sustainable Development of Small Island Developing States, or Barbados Program of Action (BPoA) and the related Mauritius SIDS Strategy.

Pan African Conventions and Legislative Frameworks

A series of Regional Conventions and their Protocols are addressing specific priorities of the African coastal and marine environment:

- Barcelona Convention (1976) for the protection of the Mediterranean Sea against pollution.

- Abidjan Convention (1981) for the protection and development of the marine and coastal environment of the West and Central African Region.
- Jeddah Convention (1982) for the Conservation of Red Sea and Gulf of Aden environment.
- Nairobi Convention (1985) for the protection, management and development of the marine and coastal environment of the Eastern African region.

Implementation of these Conventions is a priority for African nations and requires the reinforcement of research and operational infrastructures and the further development of existing capabilities.

The Cape Town Declaration (December 1998) set out an African Process for the Development and Protection of the Coastal and Marine Environment, thereby strengthening the two sub-Saharan Conventions (Abidjan, Nairobi) with joint implementing mechanisms through the establishment of a continent-wide Commission on Sustainable Development (in relation to Agenda 21 of UNCED). This led directly to the formation of Pan African programmes in marine and coastal areas, such as the Global Ocean Observing System in Africa and the Ocean Data and Information Network in Africa. This has also led to supporting initiatives from the African Commission of the African Union, the New Partnership for African Development through its Development Action Plan for the Marine and Coastal Environment, and the African Regional Economic Communities.

At a national level, all African coastal countries have enacted their own legislation to manage and protect their marine and coastal areas and resources. At the same time, each country recognises the value of regional and international cooperation to address common needs and priorities through national contributions to Regional Convention Funds as well as reinforced cooperation through the Regional Economic Commissions.