An Integrated Ocean Observation and Service Network for Africa

ODINAFRICA-III

Project Proposal for Submission to the Government of Flanders (FUST 2004-2007)

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Intergovernmental Oceanographic Commission (of UNESCO)

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1. SYNOPSIS

Objective: To create and maintain a Pan African Network of in situ coastal observing Stations providing Data to the African Ocean Data Information Network.

Outline: The proposal aims to construct a Pan-African coastal observing system including a core network of tide gauges, but also making other in situ measurements where appropriate. The core network will capitalise on existing systems like the global network of tide gauges established by IOC's GLOSS programme. It will act as the nucleus for future expansion. The data stream from the observing network will be fed into the network of data centres established through the ODINAFRICA Project, and will provide the basis for development of a wide variety of products and services, so as to ensure the widest possible use for the data centres created during the ODINAFRICA Project. The observing network will make a fundamental contribution to in situ ocean observing system of Regional Ocean Observing and Forecasting System for Africa (ROOFS AFRICA) and to global networks of ocean-related data and information. ROOFS-AFRICA is part of the Global Ocean Observing System for Africa (GOOS AFRICA) and has been accepted as a key project of NEPAD.

Primary goals:

(i) Strengthen the NODCs/DNAs to enable them to produce the necessary products and services from the data streams generated by the above activities.
(ii) Strengthen the in situ observations and measurements including GLOSS network of sea-level measuring stations in Africa.
(iii) Add oceanographic and meteorological sensors to sea-level measuring stations, thereby creating integrated monitoring platforms, where appropriate and possible.
(iv) Collaborate with the Census of Marine Life (CoML) to create an African OBIS (Ocean Biogeographic Information System),
(v) Create HAB monitoring programmes in places where there is common occurrence of HABs,
(vi) Service the data and information requirements (including the provision of appropriate products and services) of these and other national and regional projects (e.g. from ICAM, from LMEs, from fisheries departments etc),

Caveat: The project will focus primarily on national priorities and requirements, while seeking to benefit from regional networking and the development of regional products and services as well as national ones.

Duration: 4 years to achieve significant results.

Budget: USD 2,300,000

National Endorsements: This proposal has been submitted by 22 IOC Member States (see endorsements and counterpart contributions in Annex III) to the Flanders UNESCO Trust Fund (FUST) for consideration in collaboration with the three IOC programmes (IODE, GOOS and ICAM) through the IOC Secretariat.

Clients: Ministries responsible for Environmental Affairs, Coasts, Ports and Harbours, Tourism, Fisheries, Marine Research, Offshore Industries and Mining, Higher Education.

Executing agencies: National agencies operating with advice from the National Management Committee, appropriate National Agencies, Oceanographic and/or GOOS Committees, and the Project Steering Committee.

Partnership within IOC: The project will comprise a partnership involving IODE (and its ODINAFRICA project), GOOS (including its GOOS-AFRICA programme), JCOMM (including its GLOSS programme), Ocean Science (including its ICAM, HAB and GCRMN programmes), to ensure the development of appropriate data streams and products.

Possible External Partners:

(i) African Institutions: African Union, NEPAD, ECOWAS, SADC, STRC/OAU, COMESA, UEMOA, ADB, BOAD, ACMAD, AGRHYMET, IGAD AARSE, Indian Ocean Commission (IOC) RASCOM, WIOMSA (See Annex IV for a list of Acronyms).

(ii) United Nations Agencies: UNESCO, IOC/UNESCO, IHP/UNESCO, FAO, The World Bank, UNDP, UNEP, ECA, WMO, IMO, UNIDO and The World Bank country-support offices.

(iii) Bilateral Partners: Flanders (Belgium), with possible additional assistance from France, Finland, UK, Spain, USA, Netherlands, Portugal, Canada, Sweden, and Japan.

(iv) International Development Agencies: USAID, JICA, EU, ACP/EU, DANIDA, SIDA/SAREC, World Space Foundation, and Volunteers for International Technical Assistance (VITA).

(v) Specialised Agencies: Regional Centres for Mapping of Resources for Development in Africa, ICSU, NAVO, ONR, UK Met Office, METEO-FRANCE, IFREMER, IRD, GTZ, CNRS, ECMWF, International Research Institute for Climate Prediction, LOICZ, START, CoML, OBIS.

(vi) National partners: All activities and service providers operating in the coastal ocean, offshore industries, maritime transportation, national meteorological offices, weather and forecasting services, ocean agencies including fisheries and environment agencies and NGOs representing coastal communities interests.

2. PROJECT DESCRIPTION

2.1 Statement of the Problem

Africa is experiencing a steady migration of its people to the coast, in response to economic opportunities. In 2015, Lagos is expected to be the third largest city in the world with a population approaching 25 million. Economic activities in the coastal ocean account for substantial proportions of the Gross Domestic Products of African coastal countries, due to growing reliance on:

- Coastal and marine living resources,
- Coastal and marine non living resources, e.g. offshore oil,
- Shipping and trade and;
- Coastal tourism.

African coastal regions are being degraded by human activities including industrialisation, population growth, and expanding socio-economic activities both on land and water. They are also naturally degraded by storm surges, droughts and floods. The pressures created by these various forces have negative socio-economic and health consequences for the people of the region.

The Implementation Plan of the WSSD places great emphasis on the need to obtain information about the environment as the basis for monitoring its behaviour and forecasting the effects of environmental change, so as to provide decision makers with the tools they need to improve and sustain development and to mitigate or reverse undesirable trends or effects. To meet the requirements of the Implementation Plan there is a pressing need to reinforce the ability of African States to acquire and use ocean measurements to support sustainable development within the marine and coastal environment. A prerequisite is the establishment of a pan-African network of coastal observing stations providing information about the present state of the marine environment, including the upper ocean and the lower atmosphere. Data from such a monitoring network is essential in addition as the basis for forecasts of environmental change, ranging from the prediction of the pathways of pollutants to the forecasting of extreme conditions such as high waves, storms, storm surges, floods, and droughts. Such a network would assist African countries to:

- Preserve healthy coastal environments,
- Promote sustainable uses of marine resources;
- Support offshore industries;
- Identify, monitor and forecast extreme events, so as to mitigate their impacts;
- Ensure safe and efficient maritime operations;
- Safeguard economic development;
- Safeguard the security and life of fishermen at sea;
- Protect human health;
- Detect and predict the effects of climate change.

2.2 Background

Some work has been done already. African countries, supported by international donor organizations, including the Global Environment Facility (GEF) of the World Bank, have implemented several national, sub-regional and regional programmes and projects in the marine and coastal environment with various levels of success. These

activities have helped to build and/or strengthen institutional capacity and to improve policies. However, few of them have focused on the collection of environmental data or the subsequent generation from it of useful products such as maps and forecasts. In part this reflects the limited availability of appropriate infrastructure and technical expertise. Where data were collected, problems arose in making them widely available, because of the important but largely neglected issue of data inter-comparability and quality control resulting from the use of non-harmonised architecture and methodology by the various institutions involved in the few joint monitoring programmes in Africa.

A recent example of a monitoring and assessment project to generate data in support of policy implementation and management in Africa is the successful GEF Gulf of Guinea Large Marine Ecosystem Project, executed by UNIDO. It emphasised the development and implementation of protocols and methodologies for monitoring and assessment programmes in the region. It used harmonised architecture and Geographical Information Systems (GIS) for data generation, archiving and retrieval. The project generated regional awareness and enthusiasm and galvanised regional actions for the protection and development of the Gulf of Guinea marine and coastal environment. Similar LME projects are now being developed for other regions, for example as the Benguela Current LME covering Angola, Namibia and western South Africa.

In the early 1980s, the UNEP Regional Seas programme led to the formulation and adoption of the Abidjan and Nairobi Conventions and their regional action plans, which have provided a framework for regional programmes and projects in the West and Central and the East African regions. Despite good intentions, the Conventions have not led to the establishment of a comprehensive and integrated monitoring system of the kind required to support decision making, and Member States agree on the need for the Conventions to be revitalised.

UNESCO's Africa-wide COMARAF project, concluded in 1994, facilitated the building of regional capacity in marine and coastal environmental management. COMARAF was the first major marine sciences programme of UNESCO in Africa. Emphasis has been put on a regional approach by increasing promotion of joint research programs as well as exchange of scientific data and researchers among participating countries on topics related to the studies, understanding and management of Mangroves and Coastal Erosion in Africa. Short-term grants and fellowships have been provided to scientists from the participating countries

The IOC's **Global Sea-Level Observing System programme (GLOSS)** worked with IOC Member States to establish in the mid 1980s a network of 300 core stations for measuring changes in sea-level. Around 40 of these stations were along the African margin and its adjacent islands. They provide a nucleus on which to build a Pan-African coastal observing system. However, as noted below, only one third of the African stations are in effect operational.

In 1998 the IOC began implementation of its **Global Ocean Observing System (GOOS)** - a project jointly shared with WMO, UNEP and IOC - and who's object is to observe the present state of the ocean and forecast its behaviour on a variety of

timescales. The African component of GOOS is GOOS-AFRICA, with North African needs being taken care of through a Mediterranean GOOS programme (MedGOOS).

In 1989 the IOC started the implementation of the **Regional Cooperation in Scientific Information Exchange in the Western Indian Ocean** region (RECOSCIX-WIO) that established an - at that time - rare framework for institutional networking focusing on the exchange and sharing of scientific information (literature). The project's funding was taken over by Belgium in 1992 until 2000. Acknowledging the success of this project in the IOCWIO region (formerly known as IOCINCWIO), countries of the IOCEA region requested IOC for a similar network and this led to the development of the RECOSCIX-CEA project, support by the Government of Flanders between 1998 and 2002. One of the activities of the RECOSCIX-WIO project was to create the Marine Species Database for Eastern Africa (MASDEA), a guideline and road map to species reports from the Western Indian Ocean. MASDEA is now a collaborative venture between the Kenya Marine and Fisheries Research Institute and Flanders Marine Institute and is available online at http://www.vliz.be/vmdcdata/Masdea/about.htm.

At the same time Flanders supported the development of national oceanographic data centres in the IOCWIO region through the ODINEA (Ocean Data and Information Network for Eastern Africa) project (1998-2001). This led to the development of the **Ocean Data and Information Network for Africa (ODINAFRICA)** project, supported by Flanders between 2001 and 2003. The ODINAFRICA project aimed at enabling member states from Africa to gain access to data available in other data centres, develop skills for manipulation of data and preparation of data and information products, and develop infrastructure for archival, analysis and dissemination of the data and information products. The objectives of the ODINAFRICA project were:

- Provision of Internet access to marine scientists in Africa;
- Providing assistance in the development and operation of National Oceanographic Data Centres and establish their networking in Africa;
- Providing training opportunities in marine data and information management applying standard formats and methodologies as defined by the IODE;
- Assist in the development and maintenance of national, regional and Pan-African marine metadata and data holding databases;
- Assist in the development of marine data and information products responding to the needs of a wide variety of user groups;
- Reinforce the RECOSCIX-CEA and RECOSCIX-WIO networks as mechanisms for the dissemination of marine data and information to various user groups in Africa;
- Assist in the development of linkages with other international projects with similar objectives (eg GOOS-Africa; Gulf of Guinea LME, etc).

In 1998 the African countries embarked on the Process now known as the **African Process on Co-operation for the Development and Protection of the Coastal and Marine Environment**, particularly in sub-Saharan Africa. Two political settings underpin that Process at the highest level. Firstly, the Pan-African Conference on Sustainable Integrated Coastal Management (PACSICOM), held in Maputo, Mozambique, in July 1998, adopted the Maputo Declaration, which specified scientific and technical recommendations on environmental priority issues in Africa

(see PACSICOM Proceedings of Workshops, published as IOC Workshop Report No. 165, and the GOOS-AFRICA Workshop Report, published as IOC Workshop Report No.152).

The **PACSICOM recommendations**, endorsed by Ministers in the Maputo Declaration, called for the following activities to provide a sound information base for local and regional planning:

(a) Formation of an Africa-wide network of national ocean data centres;
(b) Upgrading and expanding the present African network of stations for the monitoring sea-level rise;
(c) Creating a network of specialists trained in the use of data acquired by remote sensing from space satellites;
(d) Facilitating the further implementation of modern electronic communication systems such as Internet connections and data transfer mechanisms.

In addition, the Maputo Declaration recognised the need for further capacity building, especially the following, which are generic and cut across items (a) through (d):

(e) Training and education in marine sciences and technology and their application to sustainable development;
(f) Institutional strengthening; and
(g) Sustainable funding.

Subsequently, the Cape Town Conference, in December 1998, endorsed the **Maputo Declaration** and promoted intra-African co-operation, the revitalisation and implementation of the Abidjan and Nairobi Conventions, and the development of Programmes and Action Plans to protect, manage and develop Africa's marine and coastal environment.

Another follow-up to the PACSICOM Recommendations was the already mentioned **ODINAFRICA** that addresses Recommendations (a): Formation of an Africa-wide network of national ocean data centres; and (d) Facilitating the further implementation of modern electronic communication systems such as Internet connections and data transfer mechanisms. ODINAFRICA resulted in the development of a network of functioning data and information centres and the establishment of 16 new NODCs and the provision of internet access to 20 institutions.

Through the recommendations of the Maputo and Cape Town meetings the African States endorsed the **Global Ocean Observing System for Sustainable Integrated Management of Coastal and Marine Environment and Resources in Africa (GOOS-AFRICA),** whose goal is to take forward the development of observing, forecasting and environmental data management systems to serve the interests and needs of the coastal and island states of Sub-Saharan Africa.

Under the African Process, the scientific community was asked to prepare proposals for presentation to donors for funding.

In response to this call, an Africa-wide GOOS-AFRICA workshop for project identification was convened in Nairobi on 19-23 November 2001. 23 African countries were involved: Angola, Benin, Cameroon, Comoros, Congo, Côte d'Ivoire, Gabon, Gambia, Ghana, Guinea, Kenya, Madagascar, Mauritius, Mauritania,

Mozambique, Namibia, Nigeria, Senegal, Seychelles, Sierra Leone, South Africa, United Republic of Tanzania, Togo. The workshop's main objective was to consider the Maputo priorities (a) through (g)(above), and to transform them into a project proposal for an Ocean Observing System for Africa. Given that the IOC's ODINAFRICA project had already begun working on items (a) and (d), the Nairobi workshop focused on (b) ocean observations, and (c) remote sensing of the oceans from space. Working Groups were established to develop proposals for projects dealing with ocean observations, remote sensing, and the integration of both kinds of data into numerical models capable of producing environmental forecasts. The meeting brought together for the first time oceanographers, meteorologists, remote sensing specialists and modellers in a fruitful combination.

The result was the development of a proposal for **ROOFS-AFRICA,** whose goal is to provide in a timely fashion the high quality information about the marine environment and coastal meteorology that is needed by governments, industry, and the public, for management and decision making.

The ROOFS-AFRICA proposal focused on development of:

(i) The African network of in situ ocean observing systems including sea level records for monitoring coastal zones and global change,
(ii) Access to and training in the use of remotely sensed data from satellites;
(iii) The integration of these data, through numerical models, into products such as maps of present conditions and forecasts of future conditions that would be useful to decision-makers for sustainable development; and
(iv) The development of an information delivery system. The project is complementary to IOC's ODINAFRICA Project, in that it assumed that the ODINAFRICA data centres would manage the data streams required, and produce at least some of the resulting products and services.

The ROOFS-AFRICA proposal added value to the Maputo Declaration in recommending that the network of coastal stations should collect not only data on changes in sea-level, but also data on other properties of the upper ocean and the lower atmosphere, so as to underpin the development of a more comprehensive monitoring and forecasting package than could be provided by sea-level measurements alone.

The proposal for ROOFS-AFRICA was further developed by the African working groups following the Nairobi workshop. Like all GOOS activities, ROOFS-AFRICA can be considered as a tool for the achievement of the objectives of the Regional Seas Conventions and Action Plans. An initial version of the proposal was therefore presented to the Sixth Conference of the Contracting Parties to the Abidjan Convention for Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region (6-14 May 2002, in Abidjan) with successful adoption at the technical and ministerial levels.

Within the African Process, the proposal was presented to the Super Preparatory Committee Meeting for the Partnership Conference of the African Process (Abuja, 17-19 June 2002) and endorsed at the Ministerial level. On the recommendation of the Super Prep-Com, the proposal was finally presented at the Partnership Conference as part of the African contribution to the World Summit on Sustainable Development, in

Johannesburg, South Africa (24 August-6 September 2002). It has since been adopted as a core project by NEPAD. ROOFS-AFRICA can therefore be considered as one of the regional mechanisms that will facilitate the achievement of the region's goal of protection and development of the marine, coastal and oceanic environment as well as the revitalisation and strengthening of the Conventions. As a follow up to the Partnership Conference, a GOOS-AFRICA Resources Mobilisation Workshop will be held in Johannesburg from 27-31 October 2003, as one further step towards securing funds for aspects of the ROOFS-AFRICA project.

A substantial amount of information in this proposal has been taken from the ROOFS-AFRICA proposal with the consent of the GOOS-AFRICA Coordinating Committee. This has been done because of the partnership envisaged in this phase of the ODINAFRICA project. Consequently, this proposal is not a replacement of, neither is it in competition with the ROOFS-AFRICA proposal. Rather, it is to implement only one component of the ROOFS-AFRICA proposal.

2.3 Project Details and Justification

It is evident that a combination of **ROOFS-AFRICA** for data generation and **ODINAFRICA** for data management offers the potential of achieving the goal of creating a credible Africa-wide data generation and management system to provide decision-making support for the African user community (government, industry and the public).

In this proposal we focus in particular on the element of ROOFS-AFRICA that provides the ability to collect ocean information from monitoring stations around the African margin that will provide essential information to underpin the improved management of the African coastal and marine environment along the lines recommended in the WSSD Implementation Plan.

The National Oceanographic Data Centres (NODC) or Designated National Agencies (DNA) established through the ODINAFRICA project will provide the data management services required and will assist in the development of data products.

The combination of ROOFS-AFRICA and ODINAFRICA will therefore create an integrated system that generates a data stream that leads to relevant services and products. This will also ensure that the substantial capacity built within the framework of ODINAFRICA will be fully utilized and strengthened.

The outer space-based remote-sensing aspects of the ROOFS-AFRICA project are being dealt with separately, for example through the UNESCO crosscutting project on the Application of Remote Sensing for the Integrated Management of Ecosystems and Water Resources in Africa. Through the cross-cutting project a network of African remote sensing centres and institutions has been created, and significant progress had been made in building up and developing education and training in remote sensing technology and satellite applications including satellite oceanography in a number of African countries. Based on the initial successful implementation of the above cross-cutting efforts, a partnership is now being built with the Committee on Earth Observation Satellites, for instance through a meeting between African scientists and remote sensing agencies and specialists in Stellenbosch on October 2-3, 2003.

The present proposal addresses the need to collect data, to send that data stream to appropriate national ocean data centres, and to add value to the data by converting them into information in the form of maps, trends and indices, forecasts or other such products of immediate use to decision makers, be they government officials, private enterprise managers or individual fishermen.

The primary recipients of ROOFS-AFRICA data will be the meteorological and ocean institutions capable of producing relevant products needed by end-users.

2.4 Project Objectives

The overall project will have certain specific objectives:

- Strengthening the institutional capacities of national oceanographic institutions to build greater collaboration and co-operation in joint programming;
- Contributing to creation of a regional oceanographic database;
- Networking with existing regional programmes and projects with a view to establishing co-operation;
- Enhancing national and regional awareness levels and making oceanographic data available to stakeholders to aid marine and coastal environmental management.

Expected key results will be:

- An upgraded in-situ ocean measurements network in Africa;
- Improved near real-time acquisition and exchange of ocean observations;
- Improvements in regional coastal sensitivity maps, for pollution and coastal erosion, and as a tool for coastal zoning;
- Improved warnings of extreme events (floods, droughts, storms, surges);
- Improved knowledge on the available information on local species distributions, and possible existence of biodiversity hotspots;
- Established and strengthened capabilities in the national and regional oceanographic centres and reinforced networking among relevant centres;
- Enhanced human resource capacities in the relevant sciences and appropriate technology;
- Increased awareness of stakeholders' needs;
- Improved livelihood of local communities.

3. WORK PACKAGES

To facilitate the implementation of the project it is divided for convenience into a set of 4 Work Packages (WP), in each of which the potential stakeholders should be involved to ensure that the outcomes are relevant to users' needs:

1. Project management and co-ordination
2. The coastal ocean observing system
3. Data and information management
4. Product development, end-user communication and information delivery system

3.1 WP 1. Project Management and Coordination

The main objective is to ensure that the work programme is implemented as anticipated, producing expected deliverables in a timely fashion with respect to the agreed time frame and roadmap. Keys for the success of the project are the co-ordination of activities and responsibilities within the Project Management Team; the optimization of human and technological resources; and building up a strong co-operative and coordinating network.

3.1.1. Project Management Structure

The project will be steered by **a Project Steering Committee (PSC)** comprising:

- Project Manager (appointed) half-time P3
- GOOS AFRICA Representative
- IOCEA Chair
- IOCWIO Chair
- Donor

The PSC will direct, monitor and supervise the overall implementation of the project. The PSC will also maintain and strengthen contacts between partners.

The Project Manager will have Secretarial backup support from the **Project Secretariat (PS),** which will comprise the Project Manager (in the Field) supported by IOC staff (at Headquarters and/or Field), and will:

- Ensure co-ordination and implementation of the project;
- Organise relevant meetings and
- Report and disseminate information on project activities.

A **Project Management Committee (PMC)** shall comprise:

- Project Manager
- Team Leader (WP 2)
- Team Leader (WP 3)
- Team Leader (WP 4)

The PMC will oversee the activities of the National Project Management Committees, which may comprise:

- National IOC Committee
- GOOS-AFRICA Committee representative;
- National ODINAFRICA (data and information centres) representative;
- A Selection of national experts in appropriate fields; and
- Representatives of Stakeholders.

3.1.2. Project Evaluation

Evaluation of the project will be done twice during the duration of the project i.e. mid term and end of project. The evaluation of the project shall be done by an external consultant

The PSC and the PS will ensure linkages to other national or regional activities (including trans-boundary aspects), so as to exploit existing capabilities and add value to them. These will include:

- Relevant national programmes;

- Regional Large Marine Ecosystems (LME) Programmes including the Guinea Current and Benguela Current LMEs;
- The Abidjan and Nairobi Conventions;
- The follow up to the GEF/MSP of the African Process on Co-operation for the Development of the Marine and Coastal Environment within the framework of NEPAD Environment Initiative;
- CLIVAR-AFRICA - an international programme sponsored by the IOC, WMO and the ICSU with particular focus on African climate variability;
- PIRATA - the Pilot Research Moored Array in the Tropical Atlantic, an international network of in situ met-oceanic observations measuring, in key points of the tropical Atlantic ocean, measuring various variables of the energy transfer between the atmosphere and the mixed layer (until 500m of depth);
- GIWA – the Global International Waters Assessment programme;
- AMMA – the African Monsoon Multidisciplinary Analyses programme to improve African capacity to understand and forecast of the African monsoon; and
- ACMAD – the African Centre for Meteorological Applications and Development to provide oceanographic data, and to benefit from ongoing activities in numerical weather forecasting and climate prediction.
- IOI operational centres

3.2 WP 2 The Coastal Observing System

3.2.1 The Observing System

An African network of in-situ ocean measurement stations is a key element of an African coastal ocean observation system. It should measure a range of variables. The IOC's Integrated Strategic Design Plan for a Coastal Ocean Observing System as part of GOOS (IOC/INF-1183; GOOS Report 125) recommends the following core measurements (table 4.3), with their ranks being taken from table 4.2:

Table 1. Core Variables recommended to be measured as part of the global coastal system.

PHYSICAL	rank	CHEMICAL	rank	BIOLOGICAL	rank
Sea-level	1	Sediment organic content	7	Benthic biomass	8
Water Temperature	2	Dissolved inorganic nitrogen, phosphorus, silicon	13	Phytoplankton Biomass	14
Salinity	5	Dissolved oxygen	10	Faecal Indicators	18
Currents	3				
Surface Waves	6				
Changes in Bathymetry	4				
Changes in Shoreline Position	9				
Sediment grain size	7				
Attenuation of solar radiation	16				

Table 2. Variables that should also be used, but that may be measured by other agencies.

Meteorological Variables	Chemical Variables	Remotely-Sensed Variables	Land-Margin Variables
Air temperature	pCO2	Water Temperature	Surface-and Groundwater Transportation of:
Vector Winds		Salinity	water
Humidity		Elevation (currents)	nutrients
Wet-and-dry Precipitation		Roughness (winds)	sediments
Incident solar radiation		Ocean Colour	contaminants
		Chlorophyll	

To keep costs down, the present proposal focuses on creating or upgrading fixed coastal stations or those on fixed installations offshore, where the key measurements should be (where funding permits):

- sea-level
- water temperature
- salinity
- dissolved inorganic nitrogen, phosphorus, silicon
- dissolved oxygen
- air temperature
- vector winds
- humidity
- wet-and-dry precipitation
- atmospheric pressure

Where observations are to be made from moored buoys, the following variables can be measured in addition (where funding permits):

- currents
- incident solar radiation
- attenuation of solar radiation
- phytoplankton (biomass, HAB etc)
- faecal indicators

Historically, the African coastal states produced high volumes of quality chemical oceanographic data, both from colonial environmental programs, and early government programs after independence. Unfortunately during the last two decades of the 20th century, many programs were severely scaled back or cancelled, due to budget constraints. These valuable collections should be continued, emphasizing – where appropriate and feasible – the basic measurement suites being used in (or used by) major global programs (e.g. WOCE, JGOFS). These data will contribute directly to local coastal area management (e.g. faecal indicators and chlorophyll) and can be synthesized at various scales to provide information about local, national and regional circulation, water quality, and coastal responses to short- and long-term climate

forcing. A minimum "toolkit" of standard chemical reagents, instruments and sampling equipment, as well as usage training, in a few cases, is needed.

In order to fully understand the marine environment, as the basis for effective forecasting, it is important that monitoring be systematic and sustained for the long term. In this case long term means for decades, because we now know that the marine environment around Africa is subject to decadal scale oscillations, like the Indian Ocean Dipole, which brings warm water and wet conditions to East Africa every 10-12 years, and the Tropical Atlantic Dipole, which brings anomalously warm water and wet conditions to tropical West Africa at about the same frequency, but not necessarily at the same time. The Mediterranean may also undergo climate change possibly related to a change of phase of the North Atlantic Oscillations (NAO)

3.2.2 Sea-level measurements

As noted in the GOOS-AFRICA report, and as reinforced in the Coastal GOOS Design Plan (see Table 1 above), measurements of sea level are particularly important. As noted in Chapter 3 of the GLOSS Implementation Plan 1997 (which can be downloaded from http://www.pol.ac.uk/psmsl/training/gloss.pub.html), there are many scientific and practical applications of sea level information.

Scientific applications include research into ocean tides and the space and time-scales of variability in the ocean circulation; studies of the sea level changes which occur as a consequence of climate change; and investigations of geological processes which result in sea level changes. Two scientific topics are of great concern to Africa and receive a great deal of publicity. The first relates to investigations of the El Niño - Southern Oscillation (ENSO) phenomenon, which causes large sea level changes in the Pacific and Indian Ocean and which is related to fluctuations in global weather patterns. The second concerns long-term changes in global sea level. Recently (June 2001), the Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report (TAR) concluded that global-average sea level rose within a range of 10 - 20 cm during the past century, while global mean sea level is projected to rise by 9-88 cm between 1990 and 2100 (with a central value of 48 cm) for the full range of emission scenarios. These changes have potential social, economic and environmental consequences for coastal zones.

Practical applications include coastal engineering, in which sea level data are needed as instantaneous levels, as well as statistics of extreme levels over long periods. Short-term measurements, often with real-time data transmission, are needed for ship movements in harbours and ports, for issuing storm surge and tsunami warnings, and for the operation of sluices and barrages. Over a longer period, data are needed for tidal analysis and prediction, for control of siltation and erosion (particularly important in West Africa), for the protection of coral reefs (important in East Africa), for inputs to models to estimate the paths of pollutants and to forecast water quality, and for the design of reclamation schemes and the construction of disposal sites. In addition, they have application to fisheries through studies of upwelling (e.g. Moroccan and Namibian coasts) and throughout tropical areas. Historically, many national datum levels for land surveys are based on measurements of mean sea level over some defined period. These levels are often used to define state and national boundaries, for example as specified in the United Nations Convention on the Law of

the Sea. Low water levels are used as the datum for tidal predictions and for the datum level in hydrographic charts.

Scientific and practical applications interact in many ways. For example, knowledge of long term sea level rise will need to be input into the engineering design of coastal structures, many of which will have a lifetime of many decades or a century. Insight into the rate of sea level rise may also help in the understanding of complex coastal processes, such as sedimentation and erosion, which may result in high costs. A second example concerns sea level data assimilation into numerical models (e.g. storm surge, water quality). Understanding of the correct physics in such models is clearly a 'scientific' pursuit. However, once processes are understood, and necessary data are made available, their use is 'practical'. In all of these scientific and practical applications, the reliable exchange of high-quality data, nationally, regionally and even globally, can improve our ability to predict change on a range of time-scales. This exchange of data and operational experience, within a global programme but with local applications, is something that must be encouraged.

In spite of the potential benefits, sea level measurements around Africa began relatively recently, and the longest available records cover only about 20 years.

Recognizing the importance of sea-level measurements, the IOC at its 22nd Assembly endorsed a report on the Adequacy of the Global Sea Level Observing System (GLOSS) (see Annex I and Annex II). Africa is ideally supposed to have a network of **32** continental and island stations as part of the GLOSS Core Network (GCN). These stations are supposed to submit their data to the Permanent Service for Mean Sea-Level (PSMSL), in Bidston, UK. Their locations are shown in Figure 1, Annex I, and listed in Annex II. They include two French stations, one at La Reunion, and one on the Mayotte islands in the channel between Madagascar and Mozambique. Of these 32 stations, only **11** are considered to be **fully operational** (category 1) - (Cape Verde Islands; Kenya; La Reunion (France); Madagascar; Mauritius (2); Mozambique; Namibia; Senegal; Seychelles; Tanzania). An additional **10** have not provided any data to the Permanent Service for Mean Sea-Level since 1997, and are labelled **possibly operational** (category 2) - (Congo; Cote d'Ivoire; Guinea; Mayotte Islands (France); Mozambique; Nigeria; Sao Tome; South Africa (3)); a further **5** have not provided any data since 1988, so are considered of **historical value only** (category 3) - (Angola; Djibouti; Egypt; Ghana; Tanzania); and **6** have **not reported at all** (category 4) - (Madagascar; Morocco; Sierra Leone; Somalia (2); South Africa (1 of 4).

An assessment of the GLOSS stations in Africa reveals the following:

- Regional coverage is not complete because there are no funds to install additional gauges at proposed sites.
- Not all-existing gauges in the region are operational. Lack of spare parts and adequate funds to run the stations have led to some stations becoming non-operational.
- Not all stations are multi-parameter gauge stations. Most gauges are old and therefore not equipped with additional sensors for measuring meteorological variables.

- Not all gauge stations are GLOSS stations. Accessing data from non-GLOSS stations is not guaranteed since these stations do not submitted their data to GLOSS or other data centres.
- Poor or non-existence of communication facilities for data transmission and exchange. Most countries are developing, and hence they lack the necessary infrastructure (e.g. telephone, email, etc).
- Maintenance capacity for tide stations in the region is low. This is because there are limited personnel who have received training on maintenance of tide stations.
- No gauge has a GPS in Africa. The GPS method of monitoring vertical land movements at the tide gauge site is a relatively new technique. Since most gauges in Africa are old and also lack operational funds, they have yet to adapt this technique.
- The existing sea level data has not been synthesized and analysed locally.

From these various assessments of the GLOSS programme status in Africa, it is clear that much work remains to be done to make the present GCN stations fully operational in Africa. Information from the African coast is needed not only for the solution of uniquely African problems, but also to contribute to the global sea-level monitoring network that underpins global efforts to understand and forecast climate change.

Naturally, the GLOSS stations do not represent a comprehensive sea-level observing system for Africa. They are merely the subset of African stations that were considered useful for global as well as African purposes.

Therefore, in addition to the sites of the GCN, the ROOFS-AFRICA proposal recommended 27 additional sites at which it was considered that sea-level and other measurements should be made as the basis for a comprehensive observing system for Africa (see Annex II). The stations were selected based on the following criteria:

(i) Obtaining high spatial resolution in sea level observations, to improve the quality of the data needed for scientific and management proposes, and for local, regional and international use.

(ii) Obtaining sufficient time series of data to update the tidal constituents, required in providing aid for navigation (i.e. to produce tide predictions).

(iii) Monitoring sea level variability in relation to processes such as the variation of coastal currents (Somali Current, East Africa Coastal Current and Equatorial counter current, Moroccan and Mozambique currents), so as to understand better the behaviour of these currents as the basis for forecasting change in their strengths or trajectories.

(iv) Monitoring sea-level change caused by upwelling along the coasts of Cote d'Ivoire, Ghana and Namibia, so as to improve forecasts of upwelling strength and timing for fisheries.

(v) Monitoring sea-level as the basis for predicting storm surges and associated flooding caused by tropical cyclones especially around tropical island states.

If all of the Pan-African GLOSS stations were operational, and 27 new stations were added, there would be a network of 67 tide gauges along the African coastline including the island states. A consolidated table in Annex II shows, based on the

GLOSS Adequacy Report and other considerations, where additional effort is required to meet the sea-level requirements of the GCN. Some countries do not require additional effort either because all possible is being done from national or international resources, or because the GLOSS Group of Experts believes that new funding would not necessarily bring improvements (e.g. if there are practical reasons why recording is impossible, or where GLOSS has had no contact in recent years in spite of many efforts). Based on this information the GLOSS Group of Experts have provided and assessment of the consolidated list and indicated site priorities.

In summary, the African tide gauge network is in urgent need of an injection of funds (i) to extend and complete the network; (ii) to modernise the equipment; (iii) to take advantage of new technologies to extend the capabilities of the network to provide additional information; (iv) to improve communication speeds, making the data available in real time for more practical use by the wider community; (v) to calibrate satellite data; and (vi) to validate outputs from numerical models.

3.2.3 Measurement of other core variables

At relatively small extra cost, sea-level measuring stations on piers or offshore platforms can be equipped with an addition range of devices to measure water properties, such as temperature, salinity, nutrients and so on (see lists above).

These ancillary measurements are essential to create a comprehensive picture of ocean conditions around the African margin. They are necessary as the basis for assessing ecosystem health, monitoring water quality and marine pollution, and contributing to an understanding of the conditions controlling marine resources.

Installing such sensors on sea-level stations, in appropriate locations, will be included in the project.

3.2.4 Implementation Strategy

The implementation strategy for WP 2 will be based upon a combination of procurement and installation of equipment, training and operational support, in line with the successful ODINAFRICA strategy:

- Procurement of new and multi parameter equipment (tide gauges plus ancillary sensors). And more buoys where funds permit.
- Identification of suitable sites for new equipment installation.
- Installation and maintenance of equipment.
- Upgrading of communication facilities at observing stations.
- Provision of software for analysis of data
- Training and other relevant capacity building
- Use of Satellite images (see work package 3)

<u>Installation of Equipment</u>
Experts from the University of Hawaii Sea Level Centre (UHSLC) and PSMSL, as well as available experts from specialised institutions and centres within the region, will be contracted to install modern tide gauges (some of which will have multi parameter sensors). They will also rehabilitate the existing stations by equipping them with additional sensors for measurements of meteorological variables (e.g. sea surface

temperature, salinity, wind speed and direction, atmospheric pressure, precipitation, etc). These experts shall be assisted by the appropriate national institutions of the respective countries, and relevant regional coordinators. Software for the analysis of tidal data in the three sub-regions will also be provided.

Training

To achieve a regional network that is fully operational, there is an urgent need to develop capacity. This shall be achieved by training local technicians on tide gauge installation, maintenance and benchmark levelling. Scientists should be trained on quality control of sea-level data and analysis. This will ensure that Africa produces continuous high quality data for use at local and regional levels and also for contribution to international oceanographic programmes and data centres (e.g. TOGA, WOCE, UHSLC, PSMSL, etc). It is proposed that three regional workshops aimed at training scientists and technicians in Africa be conducted.

Training will also be required to accustom local staff to the operation of other ancillary equipment for the collection of oceanographic and meteorological data at each site, and to train them in the collection, recording, and use of these data.

The training will take the form that has been used by GLOSS for more than 15 years and will include:

i) Technical know-how for the establishment, calibration, day-to-day running and maintenance of an operational tide gauge
ii) Precision levelling and GPS
iii) Transmission of data (including near real time data)
iv) Quality control and management of data (including Hands On Training Sessions, HOTS)
v) Tidal analysis and other value added products.
vi) Use of data within local and regional 'operational oceanography'

WP 2 presents a challenge in that no EU-country sponsored programme has so far attempted to establish a sea level network outside its geographical area and, in our opinion, WP 2 represents the greatest source of risk for this project.

WP 2 will be successful only if hardware can be acquired centrally, obtaining cost reductions if possible. Purchase would be made under the direction of the programme technical specialists and allocated to partners. We believe that is a better method than having partners acquire their own equipment, if technical and financial risk is to be minimised. We also believe that most partners will be pleased to see responsibility for purchase handled centrally.

Once a gauge is installed, then the availability of a good local, part-time contact is critical to the success of the project. Not only does the contact have to be an enthusiastic person, but also his employer has to share that enthusiasm and value that person's activities within the local organisation. This project cannot afford to employ a full-time contact.

Therefore, the risk in this context comes from a local contact or his employer being unwilling or unable to fulfil their responsibilities for the duration of the programme. The quality of the contact will be the main parameter in success or failure. Regular

visits by a Technical Coordinator, and the establishment of personal relationships, should be an important mitigating factor.

The potential risks in WP 2 will be minimized by having all partners abide by a set of conditions similar to those specified in the GLOSS Adequacy Report (IOC, 2003). For example, security is a major issue in many parts of the world, and it will be clear that a partner will be responsible for providing an adequate amount of security for any gauge installed through the project. To avoid the vandalism that typically impacts offshore buoys, this may require 24-hour watch in certain areas

Other potential risks to WP 2 may arise from failure of hardware at no fault of the partner. The consequences of that risk can be minimised by the Technical Coordinators having access to a small pool of spare equipment.

A risk to data flow would exist if the project partners find that they cannot for various reasons meet the ongoing commitments to data quality control and data banking. This risk is minimized by the involvement in the programme of the British Oceanographic Data Centre (BODC) and UHSLC, which are the two main GLOSS-related data centres. In the event of a potential risk to the project, then alternative routes for data handling would be investigated, with the experts from BODC and UHSLC taking the responsibility to find solutions.

Objectives	
1.	Upgrade and expand the present African network for in-situ measurements and monitoring of ocean variables e.g. sea-level, temperature, salinity, currents, winds, etc.
2.	Provide near real-time observations of ocean variables.
3.	Build adequate capacity for collection, analysis and management of sea-state variables through training and procurement of equipment.
Tasks	
1a.	Installation of new tide gauge stations.
1b.	Equip existing stations with additional sensors for measuring oceanographic and meteorological variables.
1c.	Establish coastal moorings or floats at suitable locations in Africa if funding permits.
2.	Develop databases of near real-time ocean variables (with WP3)
3a.	Train local technicians, through regional workshops and distant learning, on tide gauge, buoys and float installation, maintenance and tide gauge benchmark levelling.
3b.	Train scientists, through regional workshops and distant learning, on data analysis, interpretation and quality control.
Deliverables	
1.	A comprehensive network of sea level and other Ocean measurements and monitoring stations.
2a.	Established dynamic database of ocean variables.
2b.	Enhanced contribution by Africa to GOOS through global sea level database e.g. UHSLC, PSMSL.
3a.	Strengthened scientific and technical capacity in Africa.
3b.	Tide tables.

3c.	Improve contribution of data to enable early warning system for extreme events such as storm surge, HAB

WP 2 consists of purchase of 19 tide gauges based on the priority advice provided by Dr. Philip Woodworth, Chair of GLOSS.

A local technician should be trained to:

- Handle the installations and other maintenance issues
- Technical definition and purchase of tide gauges to be used
- Site descriptions, levelling information, metadata etc. and, with help from the lead computing centre, the establishment of a technical information management system for the project.

3.3 WP 3 Data and Information Management

WP 3 will focus on strengthening the existing NODCs established under ODINAFRICA, a project established by twenty Member States of the IOC (Benin, Cameroon, Comores, Cote D'Ivoire, Gabon, Ghana, Guinea, Kenya, Madagascar, Mauritania, Mauritius, Morocco, Mozambique, Nigeria, Senegal, Seychelles, South Africa, United Republic of Tanzania, Togo and Tunisia) with support from -IOC and the Government of Flanders. The objective of ODINAFRICA was to enable IOC member states in Africa to obtain access to ocean data and information, to develop skills for manipulation of data and to develop infrastructure for archival, analysis and dissemination of the data and information products. This objective was achieved through the establishment of NODC and DNA in the participating member states.

The centres that have been established within the framework of ODINAFRICA have embarked on development of metadata databases and data archives, development of data and information products, and public awareness creation on the project's products and services. In order to improve networking between the ODINAFRICA institutions, databases developed at national level (such as directories, meta databases, library catalogues etc) have been collected, quality controlled and formatted for access via the Internet in order to encourage broader usage. Training and follow-up support in marine data and information management was provided to experts from the participating institutions. Several of the institutions have already embarked on preparation of national marine atlases. The report of the External Evaluation of the ODINAFRICA project undertaken in 2002 was positive and recommended a continuation of the project. The report identified a few areas for improvement such as internet connectivity, disparities in capacity of the different institutions, and the need for equipment for preparation of products for ICAM (eg GIS equipment).

The next phase in the development of the data and information centres should focus on using the facilities and expertise that have been developed to generate products for effective management of the coastal and marine areas of Africa. Several meetings held in Africa have identified keys issues that need to be addressed to ensure the development and protection of the coastal zones of Africa. In particular the following have been identified as key areas that need to be addressed: Coastal Erosion, management of key ecosystems and habitats, pollution, sustainable use of living resources (especially fisheries), tourism, management of ports, navigation and shipping.

In addition to the existing 20 NODCs, it is expected that five new data centres will be established as part of this project in countries that were not partners in the ODINAFRICA project and the data and information managers from these new centres will require training. The IODE marine data and information management training curricula, OceanTeacher, will be used for these training courses. The material in OceanTeacher is based on an extensive collation of international public documents on marine data, formats, software, program and data management procedures, manuals, protocols, and associated tutorials. The use of the OceanTeacher system will ensure standardisation of software, formats, methodology and training curricula and enable students to undertake self-study subsequent to group training courses.

The participating NODCs will focus on developing an integrated data management system that will cover the entire data management cycle, from the initial collection of marine observations to the development of value-added data products required by a wide range of end users. This will include the mainstreaming of new data variables not previously managed by the NODCs, such as near real-time tidal data, biogeographic data and hydrological data.

Biogeographic data streams could link to existing data systems such as OBIS, which provides global geo-referenced information on accurately identified marine species and is developing on-line tools for visualizing relationships among species and their environment. Linkages can also be to the Marine Species Database for Eastern Africa (MASDEA), which is a comprehensive species register for the Western Indian Ocean that contains species records that have been published in peer-refereed publications. MASDEA performs two roles:

i) a species register for the Eastern African region; and
ii) a road map to the scientific literature relevant to biogeographical studies in the region.

Databases similar to MASDEA will be set up for other regions involved in the project: West Africa and the Mediterranean. Where possible links will be made with existing initiatives. The register will also be compared with global lists (such as ITITS), and used to provide input for these.

National databases will be created for biogeographical data, mainly extracted from literature. The MIM component of ODINAFRICA-III will be essential in supporting this activity, in locating and managing the relevant literature sources. The resulting databases will be made available through the OBIS network providers.

OBIS providers will be installed in partner institutions; these providers will feed an African OBIS portal, and will be available to other OBIS portals.

Hydrological datasets streams will need to be identified. Collaboration with LOICZ, IHP and World Hydrological Observing System (WHYCOS) is envisaged. The impact of NODCs in the region could be improved through the integration of data on hydrological processes. River inputs have a critical impact on coastal ecosystems (introduction of pollutants, modification of water flow leading to sedimentation or erosion, change in water tables, etc) that need to be understood by coastal managers.

The Secretariat for Eastern African Coastal Area Management (SEACAM) currently maintains the Eastern African Coastal Management Database, a source of information on coastal management activities in Eastern Africa. With the planned closure of SEACAM, there is a risk that this database will be lost. The management of the Eastern African Coastal Management Database could taken over by one of the NODCs in the region and could be extended to include West Africa as this is considered as a useful tool providing information on existing environment and resource related programs.

Parallel to the installation of new sea level stations, WP 3 will include a programme of data archaeology to establish a database of historical sea level information from all partner countries and, as far as possible, from their neighbours. The Group of Experts on the Global Sea-Level Observing System (GE-GLOSS), at their 6th Session in 1999, discussed the need for data archaeology of historic sea level records to extend existing time-series and to gain access to observations that are not in digital form. The IODE Committee, at its 16th Session, supported a proposal for a sea-level data archaeology project to be coordinated by the GE-GLOSS, with the IODE-GODAR Project Leader acting as advisor to the project.

Paper documents such as old listings and internal reports will be the source of a substantial part of the data, as for the biogeographical data. The Information Management component of ODINAFRICA-III will be used to support this activity in locating and managing the relevant resources.

The rationale of the GODAR sea-level proposal is based on the fact that in many countries there are considerable amounts of historical sea-level data in paper form, such as charts or tabulations. These need to be computerized (i) to provide electronic access (ii) as a backup for data security and (iii) so that they can be subject to modern quality control and data analysis. The datasets so obtained will be valuable in several respects. First, they will provide a resource from which scientists and others can already start to learn about sea level changes along their coasts. Second, they will provide a comparison data set to which modern information can be compared to gather insight into climatological or coastal change.

The information world is in a rapid evolution in which information managers will deal with electronic resources ie accessing and creating electronic documents. The creation of an ODINAFRICA repository will make African scientific documents (publications, reports,…) more easily accessible for the ODINAFRICA community. Furthermore, by adhering to the OAI-protocol, the repository will be fully accessible to the international marine science community. Finally a repository is also a good starting point for the possible creation of an e-journal.

During ODINAFRICA-II (2001-2003) substantial investments were made in education of marine librarians, provision of basic computer equipment and integrated library management system (ILMS) software (INMAGIC). Most ODINAFRICA-II partner libraries have thus developed an electronic library catalogue. This catalogue has also been made available as a merged catalogue through the UNESCO/IOC web server.
In addition, ODINAFRICA-II developed a project web site and AFRIDIR Directory of Marine and Freshwater Professionals. Access to information about scientific

publications will also continue to be assured through the bibliographic tool ASFA, and access to current journals through access to e-journals.

In the framework of ODINAFRICA-III many of these services will be integrated, combined with a number of data and metadata services into an integrated service center at the national and regional level. First and foremost emphasis will be placed on providing these services at the institutional (intranet) and national level (internet).

Special attention will be given to regular analysis and assessment of impact on the users and use of the products and services by the users.

Objectives	
1a.	Further develop and strengthen regional NODCs to manage data streams from the coastal ocean-observing network.
1b.	Further develop and strengthen regional NODCs to obtain, analyse and disseminate operational in-situ measurements from global programs (e.g. Argo and ships-of-opportunity).
1c.	Further develop and strengthen regional NODCs to obtain, analyse and disseminate Level 3 satellite imagery/analyses to the local/national community.
1d.	Support continued cataloguing of unpublished (or newly identified) datasets within the MEDI system.
1e.	Support continued delivery of selected CD-ROM databases to member States, as they are published by international research and archiving programs.
2.	Upgrade internet access to all NODCs using VSAT and other available technologies.
3.	Upgrade computer systems in NODCs.
4.	Integrate biogeographic and hydrological data steams into NODC systems.
5.	Build capacity for data and information managers for new NODCs established as part of this project.
6.	GODAR sea level project
Tasks	
1.	Support the operations of NODCs/DNAs to manage delayed mode and near real time data streams.
2.	Upgrade existing internet access to VSAT or similar technology.
3.	Upgrade computer systems in NODCs.
4.	Identify national and regional biogeographic and hydrological datasets
5.	Train data and information managers from the newly established centres.
6.	Assess requirements for sea level data archaeology and locate historical datasets.
Deliverables	
1a.	A comprehensive network of sea level and other Ocean measurements and monitoring stations.
1b.	Strengthened capacity in management of operational in-situ data.
1c.	Strengthened capacity in management satellite imagery data.
1d.	African component of MEDI
1e.	National Marine Database Collections
2a.	Established dynamic database of ocean variables.
2b.	Enhanced contribution by Africa to GOOS through global sea-level database e.g. UHSLC, PSMSL.

3.	Updated date data management computing systems.
4.	Integrated biogeographic and hydrological data streams.
5.	Strengthened data and information management capacity in the region.
6.	Archive of historical sea level data.

3.4 WP 4 Product Development, End-user Communication and Information Delivery

The provision of a continual stream of oceanographic data to data centres provides the essential pre-condition for the generation of a wide range of products for potential users. Products range from tidal forecasts for a port, to storm surge forecasts for a region, to maps of sea surface temperature, and to forecasts of changing oceanic and atmospheric conditions on a variety of time scales (hourly, daily, monthly, yearly, seasonally). Individual data centres could generate many products, however, a key role for data centres is to identify the best use that can be made of their data. In many countries operational forecasting of ocean conditions (waves, swell, storm surges, currents, and so on) is done by the meteorological services, which need improved ocean data streams to improve their forecasts. Therefore to achieve improved forecasts as an outcome requires data centres to forge partnerships with appropriate partners nationally and/or regionally. In many instances it is the partners who will have the desired numerical modelling capability. Nevertheless, numerical modelling should be encouraged within data centres for the production of more advanced products than simple maps.

End-user delivery and communication will build up a delivery system tailored to the requirements of end-users, and derived from interactions with stakeholders during the development of the project. Efforts must be made to ascertain end-users' needs and the potential socio-economic benefits of the activities. Among other things, this requires development of a methodological approach for assessing and monitoring the impacts of the project's products at the continental level.

The objectives, tasks and deliverables for WP 4 are as follows:

Objectives	
1.	Identify and develop ICAM related products.
2.	Develop Regional and National Marine Atlases.
3.	Improve atmospheric and oceanic monitoring through database development and communication.
4.	Promote basic modelling and forecasting through networking.
5.	Refine the identification of end-users.
6.	Awareness campaigns involving all stakeholders at local, national and regional levels on the output of the project.
7.	Disseminate outputs of the project to all stakeholders.
8.	Disseminate information on the end products at regional and international institutions.
9.	Assess the impact of products on the end-user.
Tasks	
1a.	Identify data centres and research teams interested in participation in ICAM at the national level, including national consultation.

1b.	Identify data and information on local species distributions.
1c.	Identify regional biodiversity hotspots and nursery grounds for commercially important species, to assist in planning for marine protected areas.
1d.	Identify information, data, and products requirement for the development of national/local ICAM plans.
1e.	Build capacity in the development of coastal sensitivity mapping, with special focus on erosion and marine pollution through GIS applications.
1f.	Develop capacity in environmental reporting with special focus on coastal ecosystem change through the establishment of an Environment Information System.
1g.	Develop Risk and Vulnerability Index to Extreme Events in Coastal Zones.
2.	Provide support for the development of Regional Marine Atlases for each NODCs .
3a.	Build historical database on coastal ocean.
3b.	Build databases for near real-time coastal ocean observing networks.
3c.	Establish long-term relation between national meteorological and hydrological services, coastal oceanographic institutions and environmental agencies.
3d.	Contribute to the Global Ocean Observing System of the World Weather and Ocean Watch.
4a.	Identify centres and research teams interested in participating in ocean modelling and forecasting.
4b.	Strengthen the existing national data centres to make the best use of regional products.
4c.	Improve global data exchange dissemination and processing (GDPS).
4d.	Provide adequate national centre infrastructure and operating conditions.
4e.	Strengthen the network of national and regional capacities in coastal ocean modelling and forecasting.
5.	Design and distribute questionnaire to potential end-users.
6a.	Produce newsletters, posters and brochures.
6b.	Create a web site and a communication channels.
7a.	Organise seminars/workshops.
7b.	Transfer of the end products to the users.
8a.	Exchange of data, newsletters, brochures, etc, with other regional and/or international end-users/stakeholders
8b.	Share experiences with other institutions dealing with coastal and ocean activities.
9.	Assess the impacts of end products to the end users (e.g. socio-economic, sustainable livelihoods)
Deliverables	
1a.	List of centres, parameters and interests at the national level,
1b.	National and regional species lists produced; contribution to OBIS.
1c.	National Environmental Action Plans created/updated.
1d.	National Assessment Report produced.
1e.	(a) Training courses organised at regional level, (b) A set of Atlas published as a pilot project.
1f.	(a) National State of Coast Reports produced, including shoreline changes profiles, (b) Set of indicators for specific issues developed (C. Erosion, etc).
1g.	(a) Methodology developed and disseminated to develop vulnerably index for coastal areas, (b) Mitigation strategies identified.
2.	Regional and National Marine Atlases

3a.	(a) Historical database on coastal ocean established, (b) Training to update, control and rescue historical data completed.
3b.	(a) Study database models for coastal ocean observing systems, (b) Develop database to optimise coastal data, c) Implement database,
3c.	(a) List of institutions relevant to HOME network and potential field of collaboration (technology, modelling, database), (b) Sensitisation/information workshop organised and prototype MOU drafted, (c) MOU signed by stakeholders and/or relevant institutions.
3d.	(a) Potential contribution of GOOS-AFRICA to World Weather and Ocean Watch established, (b) Protocols of partnership established.
4a.	List of programmes and products of relevant institutions.
4b.	a) List of regional products of relevance to Africa, (b) List of products developed by the national centres using the regional products.
4c.	(a) List of the relevant data and source, (b) Data processing system are built and operational.
5a.	List of end-users and their specific needs.
5b.	National survey and report on impacts of end-products
6a.	Newsletters, posters and brochures published by the stakeholders.
6b.	Website and electronic discussion group established.
7a.	Update of the end products.
7b.	Accessibility and easy use of the end products.
8.	Availability of data, newsletters etc, for other institutions.
9.	National reports and surveys

4. PROJECT WORKPLAN AND BUDGET

The following tables detail the annual activities and estimated costs for each WP.

4.1 WP 1. Project Management and Coordination

Work Package:	**1. Project Management and Coordination**				
Year:	**1**	**2**	**3**	**4**	**Total**
Cost:	**$75,300**	**$75,300**	**$75,300**	**$74,100**	**$300,000**

Objectives

- Ensure that the work programme is implemented as expected.
- Ensure expected deliverables are produced in a timely fashion with respect to the agreed time frame.
- Report and disseminate information on project activities.

Activities

Year 1		
1	Project Manager (Consultant P-3 ½ time)	$21,000
2	Team leaders WP2 ($500 per month)	$6,000
3	Team leaders WP3 ($500 per month)	$6,000
4	Team leaders WP4 ($500 per month)	$6,000
5	Meeting PMC (4 days/4 persons)	$6,400
6	Meeting PSC (4 days/7 persons)	$11,200
7	Management costs - Project Manager	$3,000
8	Management costs - Team Leaders	$4,500
9	Management costs - IOC	$10,000
10	Official travel (as required)	$1,200
Year 2		
1	Project Manager (Consultant P-3 ½ time)	$21,000
2	Team leaders WP2 ($500 per month)	$6,000
3	Team leaders WP3 ($500 per month)	$6,000
4	Team leaders WP4 ($500 per month)	$6,000
5	Meeting PMC (4 days/4 persons)	$6,400
6	Meeting PSC (4 days/7 persons)	$11,200
7	Management costs - Project Manager	$3,000
8	Management costs - Team Leaders	$4,500
9	Management costs - IOC	$10,000
10	Official travel (as required)	$1,200
Year 3		
1	Project Manager (Consultant P-3 ½ time)	$21,000
2	Team leaders WP2 ($500 per month)	$6,000
3	Team leaders WP3 ($500 per month)	$6,000
4	Team leaders WP4 ($500 per month)	$6,000
5	Meeting PMC (4 days/4 persons)	$6,400
6	Meeting PSC (4 days/7 persons)	$11,200
7	Management costs - Project Manager	$3,000
8	Management costs - Team Leaders	$4,500
9	Management costs - IOC	$10,000
10	Official travel (as required)	$1,200
Year 4		
1	Project Manager (Consultant P-3 ½ time)	$21,000
2	Team leaders WP2 ($500 per month)	$6,000
3	Team leaders WP3 ($500 per month)	$6,000
4	Team leaders WP4 ($500 per month)	$6,000
5	Meeting PMC (4 days/4 persons)	$6,400
6	Meeting PSC (4 days/7 persons)	$11,200

7	Management costs - Project Manager	$3,000
8	Management costs - Team Leaders	$4,500
9	Management costs - IOC	$10,000

4.2 WP 2 The Coastal Observing System

Work Package:	**2. The Coastal Observing System**				
Year:	**1**	**2**	**3**	**4**	**Total**
Cost:	**$348,000**	**$335,000**	**$28,500**	**$28,500**	**$740,000**

Objectives

- Upgrade and expand the present African network for in-situ measurements and monitoring of ocean variables e.g. sea level, temperature, salinity, currents, winds, etc.
- Provide near real-time observations of ocean variables.
- Build adequate capacity for collection, analysis and management of sea-state variables through training and procurement of equipment.

Activities

Year 1		
1	Procurement of 10 tide gauges	150,000
2	Installation of 10 tide gauges	70,000
3	Maintenance of tide gauges	10,000
4	5 Oceanographic Stations (wind, currents, salinity, temperature etc)	70,000
5	10 Laptops attached to Tide Gauge stations	15,000
6	Data Transmission Cost	5,000
7	Training Course (10 countries)	28,000
Year 2		
1	Procurement of 9 tide gauges	135,000
2	Installation of 9 tide gauges	63,000
3	Maintenance of tide gauges	19,000
4	5 Oceanographic Stations (wind, currents, salinity, temperature etc)	70,000
5	9 Laptops attached to Tide Gauge stations	13,500
6	Data Transmission Cost	9,500
7	Training Course (9 countries)	25,000
Year 3		
1	Maintenance of tide gauges	19,000
2	Data Transmission Cost	9,500
Year 4		
1	Maintenance of tide gauges	19,000
2	Data Transmission Cost	9,500

4.3 WP 3 Data and Information Management

Work Package:	**3. Data and Information Management**				
Year:	**1**	**2**	**3**	**4**	**Total**
Cost:	**$352,700**	**$194,900**	**$139,400**	**$113,000**	**$800,000**

Objectives

- Further develop and strengthen National Oceanographic Data Centres (NODC) in the region to manage data streams from the coastal ocean-observing network.
- Upgrade internet access to all NODCs using VSAT or other available technologies.
- Upgrade computer systems in NODCs.
- Integrate biogeographic and hydrological data steams into NODC systems.
- Build capacity for data and information managers for new NODCs established as part of this project.
- Rescue historical sea level data

Activities

Year 1		
1	Operational expenses for NODCs	$44,000
2	Mainstreaming biogeographic data (OBIS/MASDEA) ($1,000 per country)	$22,000
3	OBIS data management course	$49,800
4	Obtention of national hydrological data ($500 per country)	$11,000
5	Sea level data archaeology	$10,000
6	Equipment upgrades NODCs. ($1,500 per country/20 countries)	$30,000
7	Transfer SEACAM database to a regional NODC.	$1,000
8	Data management follow up support	$10,000
9	DM and IM training course for new countries	$9,000
10	PC equipment for new countries	$8,000
11	Operational expenses for Information Centres	$44,000
12	INMAGIC web modules (15 copies)	$30,000
13	Journal acquisitions	$10,000
14	Interlibrary loan service	$7,500
15	Equipment upgrades Information Centres. ($1,500 per country/20 countries)	$30,000
16	Information management follow up support	$10,000
17	Internet access	$26,400
Year 2		
1	Operational expenses for NODCs	$44,000
2	Mainstreaming biogeographic data (OBIS/MASDEA) ($1,000 per country)	$22,000
3	Obtention of national hydrological data ($500 per country)	$11,000
4	Sea level data archaeology	$10,000
5	Data management follow up support	$10,000
6	Operational expenses for Information Centres	$44,000
7	Journal acquisitions	$10,000
8	Interlibrary loan service	$7,500
9	Information management follow up support	$10,000
10	Internet access	$26,400
Year 3		
1	Operational expenses for NODCs	$44,000
2	Data management follow up support	$5,000
3	Operational expenses for Information Centres	$44,000
4	Journal acquisitions	$7,500
5	Interlibrary loan service	$7,500
6	Information management follow up support	$5,000
7	Internet access	$26,400
Year 4		
1	Operational expenses for NODCs	$33,000
2	Data management follow up support	$5,000
3	Operational expenses for Information Centres	$33,000
4	Journal acquisitions	$7,500
5	Interlibrary loan service	$7,500
6	Information management follow up support	$5,000
7	Internet access	$22.000

4.4 WP 4 Product Development, End-user Communication and Information Delivery

Work Package:	**4. Product Development, End-user Communication and Information Delivery**				
Year:	**1**	**2**	**3**	**4**	**Total**
Cost:	**$139,000**	**$184,000**	**$34,000**	**$103,000**	**$460,000**

Objectives

- National collation of ICAM related products.
- Develop Regional and National Marine Atlases
- Improve atmospheric and oceanic monitoring through database development and communication
- Promote basic modelling and forecasting through networking
- Awareness campaigns involving all stakeholders at local, national and regional levels on the output of the project
- Disseminate outputs of the project to all stakeholders
- Disseminate information on the end-products at regional and international institutions
- Assess the impact of products on the end-user
- Identification of end-users and their requirements.

Activities

Year 1		
1	National consultation for ICAM requirements	$45,000
2	Design and distribution of questionnaire to potential end-users	$5,000
3	Training course for coastal mapping sensitivity through GIS	$40,000
4	Identification and provision of necessary infrastructure for the promotion of ocean modelling for all data centres	$25,000
5	Training and support for development of Regional / National Marine Atlases	$10,000
6	Biodiversity network/setting up OBIS node (5 countries)	$10,000
7	Create project web site, production of newsletters, posters and brochures	$4,000
Year 2		
1	Development of Vulnerability Index Methodology and dissemination	$50,000
2	Support for national reports on the State of the Coast	$50,000
3	Biodiversity network/setting up OBIS node (10 countries)	$20,000
4	Training and support for development of Regional / National Marine Atlases	$10,000
5	Maintain project web site, productions of newsletters.	$4,000
6	Project seminar	$50,000
Year 3		
1	Biodiversity network/setting up OBIS node (10 countries)	$20,000
2	Training and support for development of Regional / National Marine Atlases.	$10,000
3	Maintain project web site, productions of newsletters.	$4,000
Year 4		
1	Assessment of impact of products on end users	$50,000
2	Maintain project web site, productions of newsletters.	$3,000
3	Final project workshop ($3,000 per country)	$50,000

4.5 Budget Summary

Work Package	**Total**	**%**
WP1. Project Management and Coordination	$300,000	13
WP2. The Coastal Observing System	$740,000	32
WP3. Data and Information Management	$800,000	35
WP4. Product Development, End-user Communication and Information Delivery	$460,000	20
TOTAL	2,300,000	100
Overhaed UNESCO (10%)	230,000	
GRAND TOTAL	2,530,000	

ANNEX I

GLOSS CORE NETWORK

Figure 1 shows sites in Africa in the GLOSS Core Network (GCN), which were selected by GLOSS working groups, with approximately 500 km spacing between them and with locations of oceanographic interest (e.g. Straits of Gibraltar) included. This set of stations is clearly not enough to satisfy the complete set of scientific and practical requirements for the African margin.

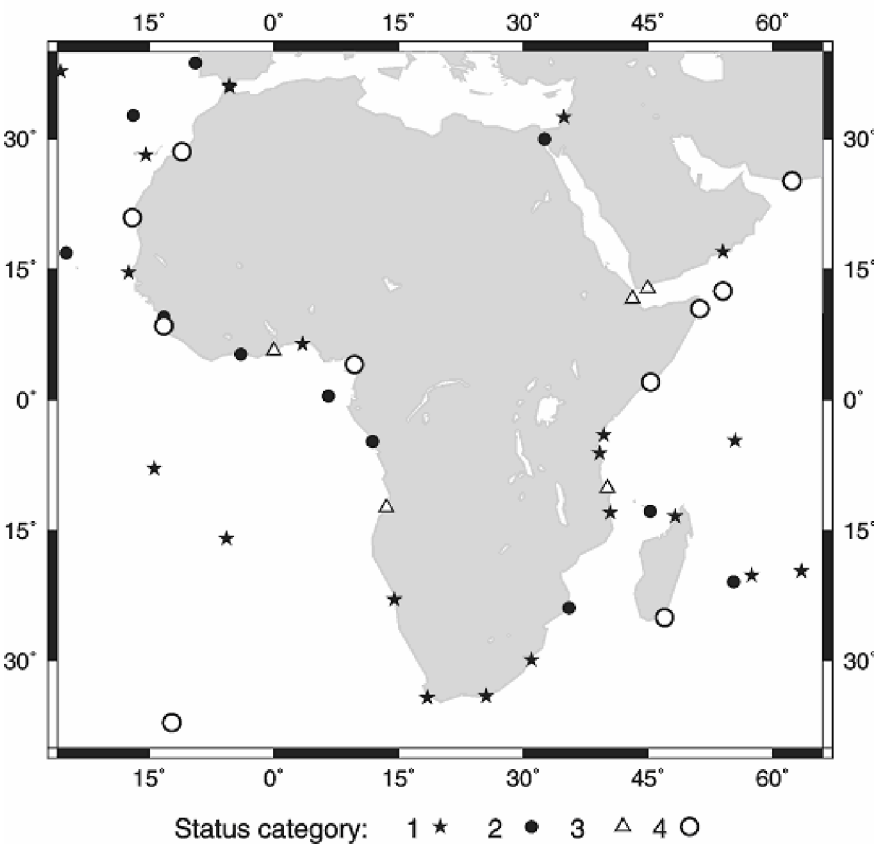

Figure 1. GLOSS status within the PSMSL dataset. October 2000

Category:
1 = operational (data provided to PSMSL since 1997)
2 = possibly operational (no data provided to PSMSL since 1997)
3 = historical data only (no data provided to PSMSL since 1988)
4 = no data provided

Note that there is a GLOSS station at Mayotte Island, which is under France but claimed by Comoros. There is also a French station at La Reunion.

ANNEX II

GAUGES REQUIRED IN EACH COUNTRY IN AFRICA BY THE GLOBAL GLOSS CORE NETWORK

The table below provides an assessment of where new and re-equipped gauge sites ('re-equipped' will usually amount to 'new' in most cases) and upgraded sites (e.g. float gauge equipped with real-time capability) are required in each country. The table is a merge between the requirements expressed in the GLOSS Adequacy Report and the GLOSS Africa 2002 proposal. In collaboration with the Chairman of GLOSS we have provided a tentative assessment of the status and priority of the non-GLOSS CORE Network sites. GCN sites shown for new gauges need not be definite choices if, following local advice, nearby alternatives are available. The reason for priority selection in some cases is also shown; this is sometimes a qualitative assessment and comments based on local knowledge are welcomed. Column 5 lists for each country the total number of new tide gauges needed and of this, the total number of new tide gauges needed with priority ≥3. Column 6 lists the number of highest priority gauges included in WP2.

Country	Station	Priority (1-5 high)	Risk (1-5 high)	Number of gauges with high priority	Number of highest priority gauges included in WP2	Comments
Egypt	**Suez (Port Taufig)**	2	4			Some historical data. Long history of letter writing to Egypt with no reply.
	Alexandria	3	4	1	1	Not in GCN but long record from a subsiding delta area requiring data for impacts studies. Gauges exist but are old and bureaucracy precludes data transfer.
Morocco	**Casablanca**	3	2			A MORS acoustic gauge installed in 2003 but probably not to GLOSS standards and too far north for upwelling and eastern boundary current studies.
	Agadir			1	1	Not in GCN. Gauge needed for upwelling and eastern boundary current studies and as eastern boundary of Rapid Climate Change Section.
Portugal	**Ponta Delgado, Azores**	N/A				Working fine. Was a NOAA acoustic gauge since given to the Inst Hidrographico and UHSLC maintains gauge.
	Funchal, Madeira	3	2	1	0	Not clear if old gauge exists or not.
Spain	**Ceuta**	N/A				Ceuta is operated by Spanish colleagues in ESEAS. A new GLOSS gauge will be installed in Gibraltar (UK) in September 2003, thereby providing cross-strait measurements.
	Las Palmas, Canary Is.	N/A		0	0	Sonar Research acoustic gauges at Las Palmas and Tenerife.
Gambia	Banjul	4	2	1	0	Not GCN but recommended by GLOSS Africa 2002. Sensible backup to Dakar.
Senegal	**Dakar**	N/A		0	0	Modern acoustic gauge exists through US collaboration..
Cape Verde	**Palmeira**	N/A		0	0	Modern acoustic gauge exists through US collaboration
Guinea	**Conakry**	1	4	1	0	Not in GCN. Suggested in GLOSS Africa 2002 proposal.
Cote D'Ivoire	**Abidjan**	3	3	1	1	Existing short record. Good local contacts. Recommended also by

Country	Station	Priority (1-5 high)	Risk (1-5 high)	Number of gauges with high priority	Number of highest priority gauges included in WP2	Comments
						GLOSS Africa 2002 proposal.
Ghana	Tema	3	2			Not in GCN.
	Takoradi	4	2	2	2	Both Ghana sites are thought to be good locations. Pressure gauges are to be installed at both two sites by NIO, India in early 2004. However, because of the importance of the Takoradi record, the longest sea level record in Africa, we believe the site justifies a second (GAINS) gauge. Important for upwelling, coastal studies and long term trends. Good local contacts.
Nigeria	**Lagos**	3	2			NIOMR will install a new gauge in 2003/4 with data shared with GAINS. Medium length historical record with many gaps. Data needed for nearby 'mega-city'. Good local contacts at NIOMR.
	Forcados	2	2	1	1	Not in GCN. Station proposed in GLOSS Africa proposal.
Sao Tomé	**Sao Tome**	N/A		0	0	An adequate gauge exists operated by IRD, France. Data are sent to GLOSS Fast Centre.
Equ. Guinea	Malabo	1	4	1	0	Not GCN. Recommended by GLOSS Africa proposal. Little historical data.
Congo	**Pointe Noire**	2	4	1	0	Proposed by IRD, France gauge mentioned in ANNEX IV not materialised at present. Sea level may be affected to some extent by river outflow. Recommended also by GLOSS Africa 2002 proposal.
United Kingdom	**Assencion**	N/A				Working gauge owned by POL
	St. Helena	N/A				Working gauge owned by POL
	Port Stanley	N/A				Working gauge owned by POL
	Edinburgh,Tristan da Cunha	3	3	1	0	Difficult location because of swell and remote. Extensive records of sub-surface pressure.
Angola	**Lobito**	3	3	1	0	Lobito itself may not be the best location (TBD). One gauge has been promised as part of Benguela LME programme although not confirmed.
Namibia	**Walvis Bay**	N/A				Gauge working
	Luderitz	3	2	1	1	Not in GCN. But att least one good gauge at Walvis Bay or Luderitz is required for upwelling coast. A further gauge has been promised as part of Benguela LME.
South Africa	**Simonstown**	N/A				Modern radar gauge
	Marion Is.	2	5			
	Port Elizabeth	3	1			
	Durban	3	1	2	0	Port Elizabeth and Durban have acoustic systems which have not been satisfactory while Simonstown has acoustic and modern radar systems. A further gauge has been promised as part of Benguela LME programme. Marion Is. In Southern Ocean is an extremely difficult location.
Mozambique	**Inhambane**	3	2			Good local contacts and some historical sea level data at both sites, although scrappy historical records.
	Pemba	3	2			
	Chinde	1	3			Not GCN. GLOSS Africa 2002 proposal. No historical data.
	Angoche	1	3			Not GCN. GLOSS Africa 2002 proposal. No historical data.
	Vilanculo	1	3	2	2	Not GCN. GLOSS Africa 2002 proposal. No historical data.

Country	Station	Priority (1-5 high)	Risk (1-5 high)	Number of gauges with high priority	Number of highest priority gauges included in WP2	Comments
France	**Dzaoudzi (Mayotte)**	3	3			Data for 1985-95. Inquired with SHOM about data availability but no reply.
	Pte Des Galets, Reunion Is.	3	2			Historical data exist. SHOM plans to install new gauge in 2004.
	Crozet Island	3	4	3	0	Historical data exist. Operationally difficult site – last gauge destroyed in storm
Comoros	Moroni	1	4	1	0	Not GCN. Suggested in GLOSS Africa 2002 proposal. Little historical record.
Madagascar	**Nosy-Be**	3	3			An old inadequate gauge at present. Good location alongside an oceanographic institute.
	Fort Dauphin (Taolanaro)	2	3			No data
	Morondava	2	5			Not in GCN. This site was suggested in GLOSS Africa 2002 proposal. Contacts with Madagascar in recent years have been poor.
	Manakara	1	4	1	1	Not in GCN. This site was suggested in GLOSS Africa 2002 proposal.
Mauritius	**Port Louis**	4	1			
	Rodrigues	4	1			Good local contacts. Old operational gauges exist but need updating. GLOSS Africa 2002 proposal suggested also Agalega (not GCN) but that has little historical record and would be instrumentally difficult.
	Agalega	4	2	3	2	Not in GCN. GLOSS Africa 2002 proposal. Little historical record and would be instrumentally difficult.
Tanzania	**Zanzibar**	3	2			An old but adequate operational gauge exists.
	Mtwara	1	4			Old data exist but no current gauge. In far south of Tanzania and nothing known of details of site. Suggested in GLOSS Africa 2002 proposal.
	Tanga	1	3			Not in GCN. Suggested in GLOSS Africa 2002
	Mkaoni	1	3	1	1	Not in GCN. Suggested in GLOSS Africa 2002
Kenya	**Mombasa**	4	1			Good local contacts. Operational gauge exists but needs updating.
	Shimoni	1	3			Not in GCN. Suggested in GLOSS Africa2002 but that has little historical record.
	Malindi	1	3			Not in GCN. Suggested in GLOSS Africa2002. Nothing known about station.
	Kiunga	1	3	1	1	Not in GCN. Suggested in GLOSS Africa2002. Nothing known about station.
Somalia	**Hafun (Dante)**	2	4			No historical data known of.
	Mogadishu	3	4	1	0	No historical data known of.
Djibouti	**Djibouti**	2	5	1	0	Few recent contacts. Old data exist but no current gauge. Gauge needed for monitoring fluxes to Red Sea and Monsoon circulation.
Sudan	Port Sudan	3	3	1	1	Not in GCN at present, but a medium length record and local contacts exist through PERSGA. Would form centre of Red Sea network.
Seychelles	**Pt. De la Rue**	3	2	2	1	Old but adequate operational gauge exists.

Country	Station	Priority (1-5 high)	Risk (1-5 high)	Number of gauges with high priority	Number of highest priority gauges included in WP2	Comments
	Aldabra	3	2			Not in GCN. GLOSS Africa2002 proposal suggested but that has little historical record and would be instrumentally difficult.
	Amirantes	1	4			Not in GCN. GLOSS Africa2002 proposal.
	Bird Island	1	4			Not in GCN. GLOSS Africa2002 proposal.
Yemen	**Aden**	4	3	1	0	Very long record ends 1969 – historical one of 'Survey of India' sites.
Cameroon	Kribi	5	1	1	1	Not in GCN. In 1987, IOC consultant, Jean Marc Vastraete proposed an installation of a tide gauge in Kribi. Since then no development. Little historical data.
Tunisia	Sfax	5	1	1	1	Not in GCN. Tunisia with two sides on eastern and western Meditarreanean basin records the most important tides and needs at least one station. Little historical data.
Mauritania	Nouadhibou	5	1	1	1	Not in GCN. For the monitoring of upwelling and the Canary Currents. In 1987, IOC consultant, B.H. Scharringhausen proposed an installation of a tide gauge in Kribi. Since then no development. Little historical data.

Number of Pan-African GLOSS stations: 41
Number of non-GLOSS proposed stations: 23
Number of gauges with priority ≥ 3: 19

ANNEX III

NATIONAL COUNTERPART CONTRIBUTIONS AND LETTERS OF ENDORSEMENT

BENIN

Institution: Benin Halieutic and Oceanographic Centre
03 BP 1665 Cotonou, Benin
Coordinator: Mr Roger DJIMAN, Managing Director

BUDGET ITEM	Year 1	Year 2	Year 3	Year 4
STAFF				
Head of Data Centre	4600	4600	4600	4600
Technical support staff	3000	3000	3000	3000
Secretarial & General support staff	3500	3500	3500	3500
INFRASTRUCTURE				
Office space	2500	2500	2500	2500
Office furniture	3000	-	1500	-
Computer equipment	11000	-	-	-
Computer operation and maintenance	2500	2500	2500	2500
Electricity & water & Air-conditioning	3000	3000	3000	3000
Telephone/fax equipment	2500	-	2000	-
Telephone/fax usage	1000	1000	1000	1000
Internet Access	800	800	800	800
OTHER	3000	3000	3000	3000
SUB-TOTAL PER YEAR	40400	23900	24400	23900
TOTAL: USD 112,600				

CAMEROON

Institution: Agricultural Research Institute for Development (IRAD)
IRAD Polyvalent Research Station Kribi
PO.Box 219, Kribi, Cameroon
National Coordinator: Dr Jean Folack, Chef de Station

The project will be hosted by the Institute of Agricultural Research for Development (IRAD) of the Ministry of Scientific and Technical research (MINREST). Activities of the project will be implemented by the IRAD Polyvalent Research Station located at Kribi along the Atlantic Ocean. The project will be coordinated by a national coordinator and will involve all national institution already in the ODINAFRICA-II National network

BUDGET ITEM	Institutions	Year 1	Year 2	Year 3	Year 4
STAFF					
National Coordinator (75%)	IRAD	7200	7200	7200	7200
Data Manager (50%)	IRAD	3000	3000	3000	3000
Information Manager (50%)	IRAD	3000	3000	3000	3000
Expert [Observing system (30%)]	Dept Meteorology	2000	2000	2000	2000
Expert [Product Devel., End User Comm., Information Delivery (30%)]	MINEF	2000	2000	2000	2000
Technical support staff (50%) (2persons)	IRAD	3600	3600	3600	3600
Secretarial & General support staff (30%) (3persons)	IRAD	3600	3600	3600	3600

OFFICE SPACE	**Institute.**	**Area**				
National coordinator office	IRAD	$20m^2$	720	720	720	720
Data Manager office	IRAD	$15m^2$	480	480	480	480
Information Manager	IRAD	$15m^2$	480	480	480	480
Expert observing system office	Dept M.	$15m^2$	480	480	480	480
Expert Product Development office	MINEF	$15m^2$	480	480	480	480
Library	IRAD KRIBI	$75m^2$	1200	1200	1200	1200
Secretary office	IRAD KRIBI	$20m^2$	720	720	720	720
Office furniture for project: Tables	IRAD KRIBI	15	1500	1300	1000	800
Chairs	IRAD KRIBI	20	1000	800	600	400
Computer (3 need to be upgraded)	IRAD KRIBI	8	10000	8000	5000	2000
Printers (2 need to be upgraded)	IRAD KRIBI	5	1000	800	500	300
Scanner	IRAD KRIBI	1	600	400	300	200
Electricity & water & Air-conditioning	IRAD KRIBI		2400	2400	2400	2400
Telephone/fax usage	IRAD KRIBI		600	600	600	600
OTHER	IRAD KRIBI		600	600	600	600
SUB-TOTAL PER YEAR			46660	43860	39960	36260
TOTAL: USD 166,740						

COTE D'IVOIRE

Institutions: CRO: Centre de Recherches Océanologiques
CURAD: Centre Universitaire de l'Université de Cocody
CIAPOL: Centre Ivoirien Anti – pollution
Sodexam: SODEXAM
National Coordinator: Dr Yacouba Sankare

Chapter	**CRO**	**Curad**	**Ciapol**	**Sodexam**	**Total**
Offices	1000	1000	1000	1000	4000
Power + Water	1000	1000	1000	1000	4000
Security	1600	1600	1600	1600	6400
Salary of one Responsible	8000	8000	8000	8000	32 000
Salary of one technician	4000	4000	4000	4000	16 000
Salary of six field technicians	4000	4000	4000	4000	16 000
Furniture	4000	4000	4000	4000	16 000
Communication	2000	2000	2000	2000	8000
Meeting	1000	1000	1000	1000	4000
TOTAL: USD 106,400					

GHANA

Institution: Ghana Oceanographic Data and Information Centre
P.O. Box BT-62,
Tema 1, Ghana
Coordinator: DR. K.A. Koranteng

BUDGET ITEM	**Year 1**	**Year 2**	**Year 3**	**Year 4**
STAFF				
Head of Data Centre	6000	6000	6000	6000
Technical support staff	4800	4800	4800	4800
Secretarial & general support staff	7200	7200	7200	7200
INFRASTRUCTURE				
Office space	3000	3000	3000	3000
Office furniture	3000	-	-	-
Computer equipment	7000	-	-	-

Computer operation and maintenance	3000	3000	3000	3000
Electricity, water, air conditioning	2500	2500	2500	2500
Telephone/fax equipment	1500	-	-	-
Telephone/fax usage	1200	1200	1200	1200
SUB-TOTAL PER YEAR	**39200**	**27700**	**27700**	**27700**
TOTAL: USD 122,300				

GUINEE

Institution: Centre de Recherche Scientifique de Conakry-Rogbanè (CERESCOR)
Rue des Hôtels MARIADOR, BP 1615, Conakry, Guinée
Tel (224) 42 30 30 / 42 38 38, Fax (224) 43 28 76
Coordinator: Dr Sékou CISS, Chef Division Gestion Information

BUDGET ITEM	Year 1	Year 2	Year 3	Year 4
STAFF				
Head of Data Centre	3600	3720	3840	3960
Technical support staff	4440	4632	4824	5016
Secretarial & General support staff	6300	6480	6660	6840
INFRASTRUCTURE				
Office space	1800	1800	1800	1800
Office furniture	200	200	200	200
Computer equipment	1450	0	1450	0
Computer operation and maintenance	500	500	500	500
Electricity, water & air-conditioning	1980	2000	2000	2025
Telephone/fax equipment	159	0	159	0
Telephone/fax usage	180	180	180	180
Internet Access	150	150	150	150
SUB-TOTAL PER YEAR	20759	19662	21763	20671
TOTAL: USD 82,855				

Note: les frais de fourniture de bureau, usage telephone, accès VSAT internet et de maintenance d'équipement ont besoin d'être complétés par les apports du Projet.

KENYA

Institution: Kenya Marine and Fisheries Research Institute
P.O. Box 81651
Mombasa, 80 100, Kenya
Coordinator: Mr. Harrison Ong'anda

BUDGET ITEM	Year 1	Year 2	Year 3	Year 4
STAFF				
Head of Data Centre	5000	5000	5000	5000
Technical staff (observation, remote sensing, data management)	10000	10000	10000	10000
Secretarial staff	4000	4000	4000	4000
INFRASTRUCTURE				
Office space	1500	1500	1500	1500
Office furniture	1500	-	750	-
Computer equipment	3000	-	1000	-
Electricity, water, air conditioning	500	500	500	500
Telephone/fax equipment	1500	-	1000	-
Other office infrastructure and services	2000	2000	2000	2000
SUB-TOTAL PER YEAR	43000	37000	39750	37000
TOTAL: USD 156,750				

MADAGASCAR

Institution: Institut Halieutique et des Sciences Marine (IH.SM)
PO Box 141- Route du Port
CP 601-Tulear
Coordinator: Dr MARA Edouard Remanevy, Director of the Centre

BUDGET ITEM	Year 1	Year 2	Year 3	Year 4
STAFF				
Head of Data Centre and National Coordinator	6,400	6,400	6,400	6,400
Data Manager (full time)	3,100	3,100	3,100	3,100
Information Manager (full time)	3,000	3,000	3,000	3,000
Technical support staff	3,000	3,000	3,000	3,000
Secretarial & General support staff	3,000	3,000	3,000	3,000
INFRASTRUCTURE				
Office space	20,000	20,000	20,000	20,000
Office furniture	2500	-	2000	-
Computer equipment	3,500	-	-	-
Computer operation and maintenance	3,000	3,000	3,000	3,000
Electricity & water & Air-conditioning	6,200	6,200	6,200	6,200
Telephone/fax equipment	1,500	-	2000	-
Telephone/fax usage	1,000	1,000	1,000	1,000
Internet Access (*)	1,000	1,000	1,000	1,000
OTHER	2,000	2,000	2,000	2,000
SUB-TOTAL PER YEAR	**59,200**	**51,700**	**55,700**	**51,700**
TOTAL: USD 218,300				

(*) Internet Access will use VSAT. Per month cost: USD 1335.

MAURITANIA

Institution: Institut Mauritanien de Recherches Océanographiques et des Pêches (IMROP)
Coordinator: Mr Mohamed Ould El Mahfoudh

BUDGET ITEM	Year 1	Year 2	Year 3	Year 4
STAFF				
Head of Data Centre	2,333	2,350	2,360	2,500
Technical support staff	10,500	10,600	10,700	10,800
INFRASTRUCTURE				
Office space	10,000	10,000	10,000	10,000
Office furniture	2,000	2,000	2,000	2,000
Electricity & water & Air-conditioning	4,000	4,000	4,000	4,000
Telephone/fax usage	1,600	1,600	1,600	1,600
Internet Access	1,200	1,200	1,200	1,200
OTHER	3,163	3,175	3,186	2,210
SUB-TOTAL PER YEAR	34,796	34,925	35,046	34,310
TOTAL: USD 139,077				

MAURITIUS

Institution: Mauritius Meteorological Services
Saint Paul Road, Vacoas, Mauritius
National Coordinator: Mr Mohamudally Beebeejaun

BUDGET ITEM	Year 1	Year 2	Year 3	Year 4
STAFF				
Head of Data Centre	3400	3400	3400	3400
Technical support staff	4900	4900	4900	4900
Secretarial & General support Staff	1500	1500	1500	1500
INFRASTRUCTURE				
Office space	1200	1200	1200	1200
Office furniture	2000	1000	1000	1000
Computer equipment	2000	1000	1000	1000
Computer operation & maintenance	1000	1000	1000	1000
Electricity & Water & Air-conditioning	500	500	500	500
Telephone/fax equipment	900	900	900	900
Telephone/fax usage	1000	1000	1000	1000
Internet Access	1000	1000	1000	1000
OTHER	2000	2000	2000	2000
SUB-TOTAL PER YEAR	21400	19400	19400	19400
TOTAL: USD 79,600				

Institution: Albion Fisheries Research Centre (Ministry of Fisheries)
Albion
Petite Riviere, Mauritius
Coordinator: Mr D. Goorah, Divisional Scientific Officer

BUDGET ITEM	Year 1	Year 2	Year 3	Year 4
STAFF				
Head of Marine Information Centre	4240	4400	4560	4720
Technical support staff				
Secretarial & General support staff	3280	3360	3440	3520
INFRASTRUCTURE				
Office furniture	330			
Computer equipment	2000			
Computer operation and maintenance	120	132	145	160
Electricity & water & Air-conditioning	600	660	726	800
Internet Access	600	660	726	800
OTHER	2000	2200	2420	2660
SUB-TOTAL PER YEAR	13170	11412	12017	12660
TOTAL: USD 49,259				

MOROCCO

Institution: Faculté des Sciences, Université Mohamed V-Agdal
BP 1014
Rabat, MOROCCO
Coordinator: Prof Maria Snoussi

BUDGET ITEM	Year 1	Year 2	Year 3	Year 4
STAFF				
Head of Data Centre	5000	5000	5000	5000
Technical support staff	6000	6000	6000	6000
Secretarial & General support staff	2000	2000	2000	2000

INFRASTRUCTURE				
Office space	1500	1500	1500	1500
Office furniture	1000	-	1000	-
Computer equipment	4000	4000	4000	4000
Computer operation and maintenance	1000	-	1000	-
Electricity & water & Air-conditioning	3000	3000	3000	3000
Telephone/fax equipment	-	-	-	-
Telephone/fax usage	100	100	100	100
SUB-TOTAL PER YEAR	23600	21600	23600	21600
TOTAL: USD 90,400				

NIGERIA

Institution: Nigerian Institute for Oceanography and Marine Research
PMB 12729 Victoria Island, Nigeria
Lagos
Coordinator: Dr Larry Awosika

BUDGET ITEM	Year 1	Year 2	Year 3	Year 4
STAFF				
Head of Data Centre	5,000	5,000	5,000	5,000
Technical support staff	3,000	3,000	3,000	3,000
Secretarial & General support staff	2,000	2,000	2,000	2,000
INFRASTRUCTURE				
Office space	1,500	1,500	1,500	1,500
Office furniture	1,500	500	500	500
Computer equipment	2,000	1,000	1,000	1,000
Computer operation and maintenance	1,800	1,800	1,800	1,800
Electricity & water & Air-conditioning	1,500	1,500	1,500	1,500
Telephone/fax equipment	1,000	500	500	500
Telephone/fax usage	1,000	1,000	1,000	1,000
SUB-TOTAL PER YEAR	20,300	17,800	17,800	17,800
TOTAL: USD 73,700				

SENEGAL

Institutions: Direction des Pêches Maritimes (DPM)
1, rue Joris, Dakar. Sénégal ; et
Centre de Recherches Océanographique de Dakar-Thiaroye (CRODT)
km 10,5 Bd du Centenaire de la Commune de Dakar. BP. 2241 Dakar.
National Coordinator: Dr Ndiaga GUEYE, Director of DPM

BUDGET ITEM	Year 1	Year 2	Year 3	Year 4
STAFF				
Head of Data Centre	3750	3750	3750	3750
Technical support staff	7500	7500	7500	7500
Secretarial & General support staff	2500	2500	2500	2500
INFRASTRUCTURE				
Office space	2500	2500	2500	2500
Office furniture	1000	1000	1000	1000
Electricity & water & Air-conditioning	2000	2000	2000	2000
Telephone/fax equipment (**ADSL**)	2500	2500	2500	2500
SUB-TOTAL PER YEAR	21750	21750	21750	21750
TOTAL: USD 79,500				

SEYCHELLES

Institutions: Seychelles Fishing Authority
P. O Box 449
Mahe, Seychelles
National Coordinator: Rondolph Payet

BUDGET ITEM	Year 1	Year 2	Year 3	Year 4
OPERATIONAL EXPENSES				
Communications	100	100	100	100
Telephone/Fax/Courier	100	100	100	100
Internet access	4000	4000	4000	4000
Consumables (ink, paper)	100	100	100	100
Purchase of software	600	600	600	600
NATIONAL DATA ARCHIVE				
Acquisition of data/information	400	400	400	400
Maintenance and update of Metadata database	500	500	500	500
Metadata IMAGIC (information centre)	1000	1000	1000	1000
Staffing	1000	1000	1000	1000
PRODUCT DEVELOPMENT				
Website maintenance	500	500	500	500
National Awareness Workshop (2-3 day workshop)	1000	1000	1000	1000
Cataloguing	500	500	500	500
COASTAL OBSERVING SYSTEM				
Analysis and Management of the Tide Gauges	4000	4000	4000	4000
SUB-TOTAL PER YEAR	13800	13800	13800	13800
TOTAL: USD 55,200				

SOUTH AFRICA

Institution: Marine and Coastal Management
Private Bag X2
Roggebay
8012, Cape Town, South Africa
Coordinator: A.S. Johnson, Head: South African Delegation to IOC of UNESCO

BUDGET ITEM	Year 1	Year 2	Year 3	Year 4
STAFF				
Head of Data Centre	14600	15330	16100	16900
Technical support staff	11500	12075	12680	13310
Secretarial & General support staff	5750	6040	6350	6670
INFRASTRUCTURE				
Office space	670	740	800	880
Office furniture	900	-	-	-
Computer equipment	3800	-	4500	-
Computer operation and maintenance	1500	1600	1700	1800
Electricity & water & Air-conditioning	500	600	700	800
Telephone/fax equipment	500	-	-	-
Telephone/fax usage	1000	1000	1000	1000
SUB-TOTAL PER YEAR	40720	37385	43830	41360
TOTAL: USD 163,295				

TANZANIA

Institution: Institute of Marine Sciences
University of Dar Es Salaam

PO Box 668
Mizingani Road, Zanzibar, Tanzania
Coordinator: Dr Desiderius CP MASALU

BUDGET ITEM	Year 1	Year 2	Year 3	Year 4
STAFF				
Head of Data Centre	4800	4800	4800	4800
Technical support staff	10200	10200	10200	10200
Secretarial & General support staff	3600	3600	3600	3600
INFRASTRUCTURE				
Office space	4800	4800	4800	4800
Office furniture	3000	-	-	-
Computer equipment	1000	500	500	500
Computer operation and maintenance	500	500	500	500
Electricity & water & Air-conditioning	4500	4500	4500	4500
Telephone/fax equipment	350	100	100	100
Telephone/fax usage	300	300	300	300
Internet Access	780	780	780	780
OTHER (local transport)	1000	1000	1000	1000
SUB-TOTAL PER YEAR	34830	31080	31080	31080
TOTAL: USD 128,070				

TOGO

Institution: Centre de Gestion Intégrée du Littoral et de l'Environnement
Université de Lomé
BP 1515 Lomé
Coordinator: Pr Adoté BLIVI, Chef du Centre

BUDGET ITEM	Year 1	Year 2	Year 3	Year 4
STAFF				
Head of Data Centre	7200	7200	7200	7200
Technical support staff	9000	9000	9000	9000
Secretarial & General support staff	3000	3000	3000	3000
INFRASTRUCTURE				
Office space	1500	1500	1500	1500
Office furniture	3000	2000	1500	1500
Computer equipment	11000	4000	3000	2000
Computer operation and maintenance	1000	1000	1000	1000
Electricity & water & Air-conditioning	2500	2500	2500	2500
Telephone/fax equipment	1000	-	-	-
Telephone/fax usage	1200	1200	1200	1200
Internet Access	1000	1000	1000	1000
OTHER	500	500	500	500
SUB-TOTAL PER YEAR	**41900**	**32900**	**31400**	**30400**
TOTAL: USD 136,600				

TUNISIA

Institution: Institut National des Sciences et Technologies de la Mer
28 Rue 2 Mars 1934
2025 Salammbô
Coordinator: Dr Malika Bel Hassen

BUDGET ITEM	Year 1	Year 2	Year 3	Year 4

STAFF				
Head of Data Centre	5000	5000	5000	5000
Technical support staff	8500	8500	8500	8500
Secretarial & General support staff	2500	2500	2500	2500
INFRASTRUCTURE				
Office space	4000	4000	4000	4000
Office furniture	2000	1500	1500	1500
Computer equipment	4000	3800	-	-
Computer operation and maintenance	1000	1000	1000	1000
Electricity & water & Air-conditioning	1000	1000	1000	1000
Telephone/fax equipment	500	-	-	-
Telephone/fax usage	2500	2500	2500	2500
Internet Access	1200	1200	1200	1200
OTHER (local transport)	1000	1000	1000	1000
SUB-TOTAL PER YEAR	33200	32000	28200	28200
TOTAL USD 121,600				

ANNEX IV

ACRONYMS

AARSE	African Association for Remote Sensing of the Environment
ACMAD	African Centre for Meteorological Applications for Development
ACP/EU	African, Caribbean, Pacific States/European Union
ADB	African Development Bank
AMMA	African Monsoon Multidisciplinary Analyses
BOAD	Banque Ouest Africaine de Développement
BODC	British Oceanographic Data Centre
CLIVAR	Climate Variability and Predictability Programme
CNRS	Centre National de la Recherche Scientifique
COM	Coastal Ocean Model
CoML	Census of Marine Life
COMARAF	Coastal Marine Project in Africa
COMESA	Common Market for Eastern and Southern Africa
DANIDA	Danish Agency for Development Assistance
DNA	Designated National Agency
ECA	Economic Commission of Africa
ECMWF	European Centre for Medium-Range Weather Forecasts
ECOWAS	Economic Commission of the West African States
ENSO	El Niño – Southern Oscillation
EU	European Union
FAO	Food and Agriculture Organization
GCN	GLOSS Core Network
GCRMN	Global Coral Reef Monitoring Network
GEF	Global Environment Facility of the World Bank
GIS	Geographical Information System
GIWA	Global International Waters Assessment
GLOSS	Global Sea Level Observing System
GODAR	Global Oceanographic Data Archaeology & Rescue Project
GOOS	Global Ocean Observing System
GPS	Global Positioning System
GTZ	Deutsche Gesellschaft Für Technical Zusammenarbeit
HAB	Harmful Algal Blooms
HOME	Hydrology, Oceanography, Meteorology and Environment
ICAM	Integrated Coastal Area Management
ICSU	International Council for Science
IFREMER	Institut français de recherche pour l'exploitation de la mer
IGAD	Intergovernmental Authority on Development
I-GOOS	IOC-WMO-UNEP Committee for GOOS
IHP	International Hydrological Programme (of UNESCO)
IMO	International Maritime Organization
IODE	International Oceanographic Data and Information Exchange
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IOCEA	IOC Regional Committee for the Central Eastern Atlantic
IOCWIO	IOC Regional Committee for the Western Indian Ocean (formerly IOCINCWIO)

IPCC	Intergovernmental Panel on Climate Change
IRD	Institut de Recherche pour le Développement
JCOMM	WMO-IOC Joint Technical Commission on Oceanography and Marine Meteorology
JICA	Japan International Co-operation Agency
LME	Large Marine Ecosystems
LOICZ	Land-Ocean Interaction in the Coastal Zone
MASDEA	Marine Species Database for Eastern Africa
MedGOOS	Mediterranean GOOS programme
NAVO	Naval Oceanographic Office
NEPAD	New Partnership For Africa's Development
NGO	Non-governmental Organization
NODC	National Oceanographic Data Centre
OBIS	Ocean Biogeographic Information System
ODINAFRICA	Ocean Data and Information Network for Africa
ODINEA	Ocean Data and Information Network for Eastern Africa
ONR	Office of Naval Research
PACSICOM	Pan-African Conference on Sustainable Integrated Coastal Management
PIRATA	Pilot Research Moored Array in the Tropical Atlantic
PS	Project Secretariat
PSC	Project Steering Committee
PSMSL	Permanent Service for Mean Sea-Level
RASCOM	Regional African Satellite Communication Organisation
RECOSCIX-WIO	Regional Cooperation in Scientific Information Exchange in the Western Indian Ocean
ROOFS-AFRICA	Regional Ocean Observing and Forecasting System for Africa
SADC	South African Development Community
SEACAM	Secretariat for Eastern Africa Coastal Area Management
SIDA	Swedish International Development Agency
SAREC	Swedish Agency for Research Cooperation with Developing Countries
START	SysTem for Analysis, Research and Training
STRC/OAU	Scientific and Technical Research Committee of the Organization of the African Unity
TOGA	Tropical Ocean Global Atmosphere Programme
UCT	University of Cape Town
UEMOA	Union Economique et Monétaire Ouest Africaine
UHSLC	University of Hawaii Sea Level Centre
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific & Cultural Organization
UNIDO	United Nations Industrial Development Organization
USAID	United Sates Agency for International Development
WHYCOS	World Hydrological Observing System
WIOMSA	Western Indian Ocean Marine Science Association
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment
WP	Work Package
WSSD	World Summit on Sustainable Development