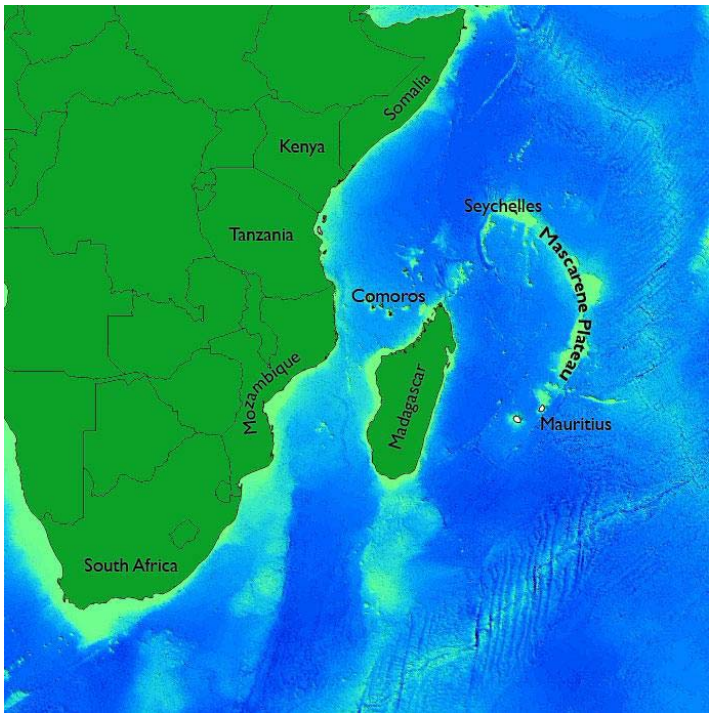
Second In-Region Capacity Building Workshop of the WMO/IOC JCOMM Data Buoy Cooperation Panel and Partners for the Western Indian Ocean

May 2-6, 2011
Venue: La Plantation Hotel
Balaclava, Mauritius



Editors
Johan Stander, South African Weather Service
Juliet Hermes, South African Environmental Observation Network
Sidney Thurston, US National Oceanic and Atmospheric Administration

Dedicated to Robert A. Luke,
Tireless Contributor to Global Ocean Observations and Service to Society

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EXECUTIVE SUMMARY

Appreciation and Acknowledgement

It is with great honor and gratitude that the IOC/WMO JCOMM Data Buoy Cooperation Panel Capacity Building Task Team (DBCP TT-CB) recognizes the hard work and significant contributions of the following Colleagues and Institutes to this series of Western Indian Ocean Workshops to build sustainable capacity for this critical Region, including parts of World Meteorological Organization Regional Association I (RA-I).

Firstly, we thank the met, ocean and fishery Institutes from the following Nations for kindly allowing over fifteen of their Associates to participate as Trainees: South Africa, Tanzania, Kenya, Saudi Arabia, Egypt, Uganda, Ethiopia, Morocco, Maldives, Mauritius, Cameroon, Seychelles, Madagascar, and Comoros.

DBCP Chair Al Wallace, David Meldrum, Etienne Charpentier and Dr. Boram Lee of the **DBCP Executive Board** contributed their significant vision towards establishing the TT-CB four years ago in Jeju South Korea and for their daily guidance for workshop preparations so deserve much of the credit for this fruitful initiative as well as for the PANGEA Concept of Resource Sharing Partnerships (www.jcomm.info/pangea-concept).

Drs. Mitra Bhikajee and Rezah Badal and their Colleagues from the **Mauritius Oceanography Institute** for their outstanding Hospitality in Hosting the 2nd Capacity Building in Mauritius. Johan Stander and Colleagues from the **South African Weather Service (SAWS)** provided the Leadership for the First workshop in Capetown in April 2011 and carried their enthusiasm into the Second Workshop in Mauritius contributing substantive recommendations.

Dr. David Vousden, Lucy Scott, Tommy Bornman, Helen Mackenzie and Colleagues from the United Nations Development Program (UNDP) ***Agulhas-Somali Currents Large Marine Ecosystem Project*** **(www.ASCLME.org)** for tireless efforts with coordinating Regional participation and stake holders, local logistics and bringing perspective of the social-economic relevance of ocean data.

Dr. Lisa Beal and Arne Biastoch, co-Chairs of the **Scientific Committee for Ocean Research SCOR-136** ***Climatic Importance of the Greater Agulhas System*** and their SCOR Colleagues for bringing rich scientific expertise on the Greater Agulhas System to the proceedings and also contributing significantly to the capacity building objectives. Dr. Augustus Vogel, **Office of Naval Research-Global** Africa and Latin America, for his valuable guidance in merging the many dimensions of this workshop.

Modelling Development Team (MDT) Leader Dr. Juliet Hermes for continuing to bring sincere passion, diligence and expertise to both the MDT preparations and training sessions. Dr. Bill Burnett and Johan Stander for their coordination and leadership of the Observing Development Team (ODT) sessions.

Drs Mark Brettenny and Diane Stanitski for connecting the next generation of scientists to this Capacity Building Workshop through the **Global Learning and Observations to Benefit the Environment** (www.GLOBE.gov) and **NOAA's Adopt-A-Drifter Program** (www.adp.noaa.gov).

Drs Francois Carnus and Eric Martial of the **African Monitoring of the Environment for Sustainable Development (www.amesd.org)** for their efforts to build synergy between AMESD remote sensing of the region with those in-situ observations of the DBCP. Drs. Yukio Masumoto and Weidong Yu, co-chairs of the CLIVAR/IOGOOS **Indian Ocean Panel (IOP),** and their Colleagues for scientific Leadership towards designing the Indian Ocean Observing System (IndOOS) to include the Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (RAMA www.pmel.noaa.gov/tao/global/status/buoystat-rama.html).

Dr. Nick D'Adamo, Head of the **UNESCO Intergovernmental Oceanographic Commission IOC Perth Regional Programme Office**, for leading the Indian Ocean Global Ocean Observing System (IOGOOS) initiative umbrella for these activities. IOC Perth also sponsored the participation of Dr Gary Brassington of **Australia's Bureau of Meteorology** to demonstrate the many attributes of the *BlueLink* Ocean Model.

NOAA's Deputy Administrator and Assistant Secretary for Conservation and Management Dr. Larry Robinson, Drs. Wassila Thiaw, Rebecca Shuford and Bill Burnett, and Meghan Cronin from the **National Oceanic and Atmospheric Administration (NOAA)** for contributing their Leadership and expertise in Climate Forecast Modelling, Ecosystems Management and Ocean Observations and Data Management.

Finally, we thank Drs. Ali Mafimbo of the **Kenya Meteorological Agency** and Charles Magori of the **Kenya Marine and Fisheries Research Institute** for leading us all forward to the Third DBCP Western Indian Ocean (WIO-3) Capacity Building Workshop in Mombasa Kenya in May 2012. This report will be used as a foundation on which to build while we are together again in Kenya. We all look forward to their timely milestones and coordination this summer in advance of the DBCP XXVII Meeting in Geneva this September.

Sidney Thurston, Ph.D.
Lead, DBCP Capacity Building Task Team

Workshop Resolutions

Resolution 1

The DBCP workshop participants recognise the growing partnerships within the WIO region in terms of Ocean-Atmosphere observations and the importance of effective coordination and sharing of resources to achieve the mutual aims and objectives in terms of data collection, analysis and its application for management and governance. The participants also recognise the role of the ASCLME Project in facilitating the development of a WIOSEA at both the scientific/technical level as well as the management and policy level. **The participants therefore encourage ASCLME to further the development of such an Alliance** in the WIO which will help to coordinate and integrate scientific effort and activities in the region with the ultimate aim of delivering end-products for management and governance in support of the social and economic needs of the countries.

Primary: ASCLME

Secondary: UNDP

Resolution 2

Recognizing the importance of collecting ocean and weather observations in data sparse areas such as the coast of Somalia where piracy precludes the security of research cruises and the placement of moorings, and currents preclude the placement of drifters. The Observation Development Team (ODT) recommends that **appropriate glider technology be used in a pilot project to see if real-time weather observations can be collected within this data sparse area.**

Primary: Ali Mafimbo

Secondary: Bill Burnett

Resolution 3

Recognizing the importance of **links between remote sensing and in-situ observations**, for long term monitoring, and modelling purposes, the UNDP/GEF ASCLME Project and the Mauritius Oceanography Institute (MOI) will pursue a collaborative agreement building on ASCLME activities in the WIO, AMESD and the proposed AMESD follow-on projects.

Primary: ASCLME

Secondary: Mauritius Oceanography Institute (MOI)

Resolution 4

Recognizing the importance of collecting ocean and weather observations in data sparse areas such as the Indian Ocean as well as the fact that members indicating willingness to become part of the International Buoys Deployment community the ODT recommends that **drifting weather buoys be supplied to African countries as a pilot project** and results be provided during the next Capacity Building Workshop. Interested participating African Met/Ocean Institutes will please provide a brief deployment plan to Primary and Secondary to include with their delivery address for the drifters shipment of when and how these drifters will be deployed.

Primary: Johan Stander

Secondary: Shaun Dolk

Resolution 5 (from WIO-1 Capetown Workshop April 2010)

During the first DBCP In-Region Western Indian Ocean Capacity Building Workshop in Capetown South Africa April 2010, representatives of Regional Met/Ocean Institutes put forward a Resolution to enhance ocean observations off the East coast of Africa to include five (5) Ocean Moored Buoys (Please see Figure 1). This resolution carried forward in Mauritius so is being included in this Second Workshop summary. Scientific justification for these additional in-situ observations off the East coast of Africa will help to better understand the following:

1. Intra-seasonal variability of the Somali jet over the East African coast and the mascarene pressures,
2. The response of the Somali current to the intraseasonal variability of the Somali Jet,
3. The dynamical and thermal feedback mechanisms between the cool temperatures in the filament and the modified wind stress,
4. The characteristics of the atmospheric convergence and divergence over the upwelling region and their influence on the climate of east African coast,
5. Specifically investigate how the SST and surface wind coupling affect vertical profile of the atmospheric boundary layer.

Primary: Kenya Meteorological Agency
Secondary: Tanzania Meteorological Agency

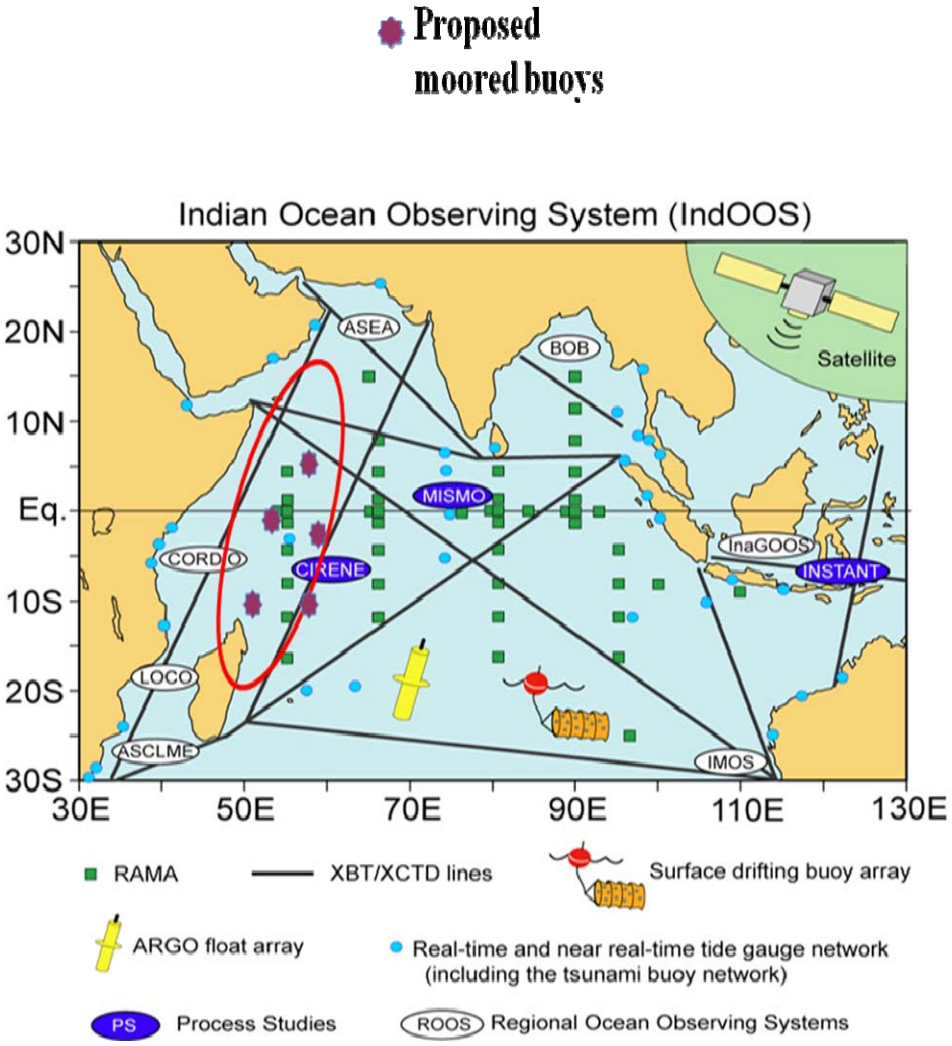

Figure 1 Proposed Western Indian Ocean Moored Buoys to Augment the Indian Ocean Observing System IndOOS

Introduction

The joint WMO-IOC Data Buoy Cooperation Panel (DBCP) supports the Observation Programme Area, overseen by joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM). The Panel has a desire to actively encourage the participation of developing countries in its activities, as a means for these nations to assist in achieving and sustaining their objectives for a globally distributed data buoy network. It is against this background that the joint Panel organized and sponsored the second training workshop (WIO-2) that was hosted by the Mauritius Oceanographic Institute (MOI) from 2 to 6 May 2011, with the aim of enhancing capacity building of countries in the Western Indian Ocean region.

The DBCP In-Region Western Indian Ocean Capacity Building Workshop Series was conceived of the DBCP Capacity Building Task Team (CB-TT). This was a follow-up from the DBCP Training Course on Buoy Programme Implementation and Data Management, held in Oostend, Belgium in 2007.

In 2009, the Intergovernmental Oceanographic Commission (IOC) identified the Western Indian Ocean Region as one of the highest priority regions for capacity building in 2009. It seemed particularly auspicious that the workshop be held in the Western Indian Ocean covering the region covered by the International Indian Ocean Expedition of 1960, which was the root of the IOC.

In November 2009, at the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) Third Session held in Marrakesh Morocco 4-11 November, endorsed the Partnership for New GEOSS Applications (PANGEA) concept. www.jcomm.info/pangea-concept PANGEA provides for in-country practical applications training of ocean data to large and diverse groups of regional participants and the workshop therefore formed part of the DBCP's contribution to the PANGEA concept.

The First DBCP In-Region Western Indian Ocean Capacity Building Workshop (WIO-1) was held in Cape Town in April 2010. The theme: *Implementation and Operations of Indian Ocean Data Buoy Networks and their Applications for Enhancing Regional Predictive Capability.*
The focus was on observations and data collection, as well as modelling products and validation by *in-situ* ocean observations, with an overall aim to link regional Meteorological/ Ocean/ climate

models and data collection networks to provide national products. Two capacity building teams were initiated – the observational development team (ODT) and the modelling development team (MDT). Presentations from the first workshop can be found on: http://www.jcomm.info/wio-dbcp

The commitment from the DBCP was that this capacity building workshop would be repeated. The WMO/IOC Data Buoy Cooperation Panel second In-Region Western Indian Ocean Capacity Building Workshop (WIO-2) was the realization of planning and preparation after the previous workshop held in Cape Town that culminated in a successful information and expertise sharing workshop.

The theme for this Second workshop was: *Implementation and Operation of Western Indian Ocean and Greater Agulhas Current Observing System: Building Links and Predictive Capacity for East African Participation.*

This year a number of different groups featured prominently in the workshop and, although this made it very full, there was an overall consensus that the attendance of such key SW Indian Ocean groups really added to the quality of the training and discussions. These groups included the Scientific Committee for Oceanographic Research Working Group (SCOR-136) On the climatic importance of the Greater Agulhas Current System; The Agulhas Somali Current Large Marine Ecosystem (ASCLME) and the African Monitoring of the Environment for Sustainable Development (AMESD). Details can be found at www.jcomm.info/wio-dbcp2

The Workshop was opened with addresses from: Dr. Rezah Badal – Officer-in-Charge, Mauritius Oceanography Institute, David Meldrum – Recent Chair, Data Buoy Cooperation Panel DBCP, Johan Stander, WMO Representative, Nick D'Adamo – Head, UNESCO IOC Perth Regional Programme Office, Lisa Beal – Chair, Scientific Committee on Oceanic Research, 136 and Troy Fitrell – Deputy Chief Of Mission , USA Embassy, Mauritius (Figure 3). Dr. Sidney Thurston of US National Oceanic and Atmospheric Administration, DBCP task team leader on Capacity Building, facilitated the programme.

The Keynote Address came from Rezah Badal (MOI) and his topic Regional Perspective: MOI's Activities and Incoming Operational Services Using Earth Observations for Marine Applications. Dr. David Vousden of the Agulhas and Somali Currents Large Marine Ecosystem Project (ASCLME), in Grahamstown, delivered the Key Address *Social and Economic Relevance of Regional S&T* for the Opening Regional Environmental Science and Technology Symposium.

The Observational Development Team (ODT, coordinated by Drs. Augustus Vogel and Bill Burnett) and the Modelling Development Team (MDT, coordinated by Dr. Juliet Hermes) were continuations from WIO-1 with the Applications Development Team (ADT) introduced during this workshop and will be further elaborated next year.

Sessions were planned in advance and a number of teleconferences were held to ensure that the capacity building sessions were as hands on and logical sequence as possible.

Although most of the participants were sponsored by the WMO, IOC or NOAA, a separate call for applicants and selection of regional scientists was made and these were sponsored by SCOR/IAPSO and the US Office of Naval Research ONR. To maximize networking, regional scientists in particular had lunchtimes which were coordinated with the SCOR scientists. These lunches (and often evening meals) were very successful and allowed the interaction in a relaxed, informal manner.

The SCOR working group also held a separate science meeting as part of its terms of reference, to which some of the regional scientists were invited. The reports and strategic planning from these meetings will be utilised where possible (eg the Indian Ocean Panel meeting) to encourage observations in the SW Indian Ocean, in particular, the Greater Agulhas Current System. The SCOR working group have recently published a review paper in ***Nature*** and this was also made available to all of the participants.

A visit to the MOI was facilitated, allowing some of the international scientists an opportunity to see the available facilities and discuss with some of the local scientists, this was of particular interest after hearing about the AMESD program.

Workshop content

The workshop was initially arranged such that there would be common sessions to be attended by all, and parallel session where the attendees could chose to attend either the Modeling or Observations stream presentations. There was a variety of presentations under both modeling and observations, ranging from the technical and logistical to the scientific.

Most of the attending countries gave presentations on the buoy/marine observations network activities in their countries. South Africa contributed significantly at the conference in terms of the activities under the various institutions. These included the South African Weather Service (SAWS), Oceans and Coast (O&C) of the Department of Environmental Affairs, South African Environmental Observation Network (SAEON), international organisations like the Agulhas Somali Current Large Marine Ecosystem (ASCLME) and the University of Cape Town (UCT).

Workshop Goals

As identified at the outset of planning, the following goals were achieved in Mauritius:

1. Continue to Build Capacity Within Regional Met/Ocean/Climate Institutes to Apply New Indian Ocean Observing System (IndOOS) Data, such as from the *Research Moored Array for African–Asian–Australian Monsoon Analysis and Prediction* (RAMA, Figure 2) and other Regional Programmes such as ASCLME, for Enhanced Predictive Capability for the Region,
2. Provide Training in Deployments and Management of in-situ Ocean Observations,
3. Coordinate synergies with African Monitoring of the Environment for Sustainable Development (AMESD) for In-situ Ocean Observations for the Western Indian Ocean,
4. Continue to Build In-Region Modelling Development Teams (MDT) and Observation Development Teams (ODT), including for the Implementation of Buoy Programmes, Additionally begin to coordinate Social-Economic Applications Development Team (ADT),
5. Develop Linkages between Offshore-Nearshore Long-Term Observations for Greater Involvement by and Benefits to Stakeholders such as for Natural Resource Management

(e.g., Fisheries, Tourism), Disaster Risk Characterization and Reduction such as Floods and Droughts and Cyclones, biodiversity conservation, and others,

6. Facilitate collaboration between existing and planned studies of the region and to contribute to capacity building in East African countries which border the Greater Agulhas System (SCOR WG 136 Terms Of Reference),
7. Identify key components of the region for further study and/or sustained observations (SCOR WG 136 Terms of Reference).

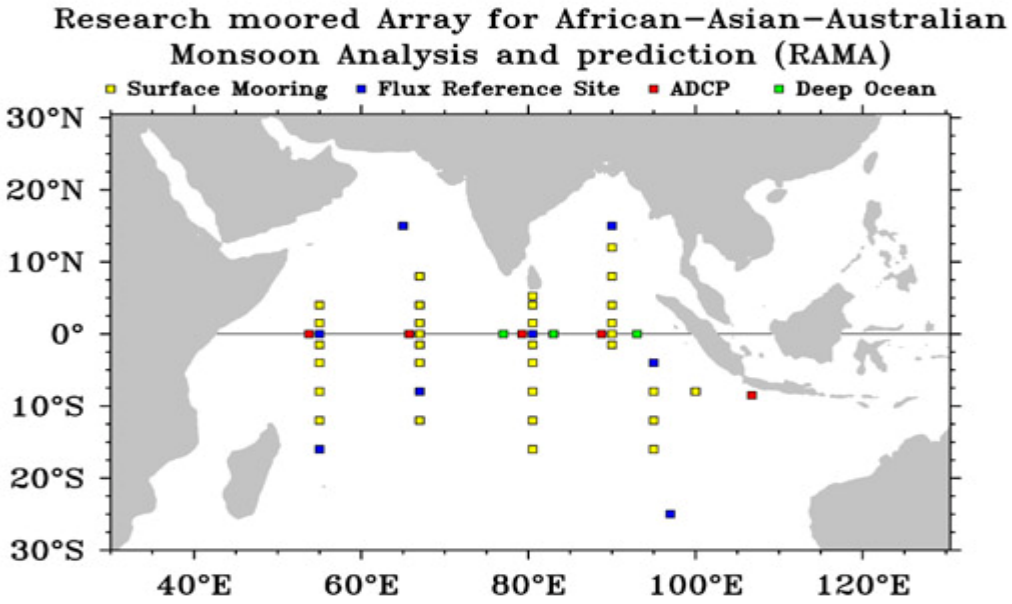

Figure 2 Full Indian Ocean RAMA Array Design
By CLIVAR/IOGOOS Indian Ocean Panel

Participating Organizations

WMO/IOC Joint Technical Committee for Oceanography and Marine Meteorology (JCOMM) Data Buoy Cooperation Panel (DBCP)

Mauritius Oceanography Institute (MOI, Host Institute)

Mauritius Meteorological Services

University of Mauritius

Agulhas and Somali Currents Large Marine Ecosystem (ASCLME) Project

African Monitoring of the Environment for Sustainable Environment (AMESD)

CLIVAR - The Variability of the African Climate System (VACS) Panel

UNESCO IOC Perth Regional Programme Office

Australia
- Bureau of Meteorology (BoM)

France
- Institute of Research & Development (IRD)

Germany
- Leibniz Institute of Marine Sciences at Kiel University (IFM-GEOMAR)

Global Learning and Observations to Benefit the Environment (GLOBE-Africa)

India
- Ministry of Earth Sciences (MoES)

Japan
- Japan Marine-Earth Science and Technology Center (JAMSTEC)
- Research Institute for Global Change (RIGC)
- University of Tokyo

Kenya
- Kenya Meteorological Department (KMD)
- Marine & Fisheries Research Institute

Mozambique National Institute for Fish Inspection (INIP)

Netherlands
- Royal Institute for Sea Research (NIOZ)

South Africa

- South Africa Weather Service (SAWS)
- Department of Environmental Affairs
- University of Cape Town
- South African Environmental Observation Network (SAEON)

SCOR (Scientific Committee for Oceanic Research)/IAPSO (International Association for the Physical Sciences of the Ocean/WCRP (World Climate Research Program) Working Group 136, On the Climatic Importance of the Greater Agulhas System

South West Indian Ocean Fisheries Project (SWIOFP)

United Kingdom

- Scottish Association of Marine Sciences (SAMS)
- National Oceanography Centre, Southampton (NOCS)

USA
National Oceanic and Atmospheric Administration (NOAA):

- Climate Program Office - Office of Climate Observation (OCO)
- National Weather Service (NWS)
    - National Center for Environmental Prediction/Climate Prediction Center (NCEP/CPC)
    - National Data Buoy Center (NDBC)
- National Marine Fisheries Service (NMFS)

Office of Oceanic and Atmospheric Research-

- Pacific Marine Environmental Laboratory (OAR/PMEL)

University of Miami/Rosenstiel School of Marine and Atmospheric Sciences (RSMAS).

Presentations

Ocean Forecasting: From Ocean Observation to Applications: Update on IOGOOS Pilot Project – Modelling for Ocean Forecasting and Process Studies by Nick D'Adamo
The Indian Ocean Global Ocean Observing System (IOGOOS) Regional Alliance involves members from about 15 Indian Ocean rim and island countries, including from the South West Indian Ocean. IOGOOS oversees and/or facilitates projects such as the Indian Ocean Observing System (IndOOS), and related Indian Ocean Panel of GOOS/CLIVAR (IOP), Sustained Indian Ocean Biogeochemistry and Ecosystem Research (SIBER) and IndOOS Resources Forum (IRF).

IOGOOS is also developing a pilot project to build capacity in the development and application of ocean forecasting systems in the Indian Ocean region. This project is being coordinated by the UNESCO IOC Perth Office on behalf of IOGOOS. The objectives have been clarified and a draft project plan developed with a focus on specific demonstration areas within the IOGOOS domain, including the South West Indian Ocean. This draft plan was provided to the DBCP 2011 Mauritius workshop through ASCLME for the reference of the workshop's regional stakeholders and to invite engagement in the project through Mauritius as the regional focal point for the South West Indian Ocean demonstration area of the pilot project.

The genesis of the pilot project was a presentation given at the IOGOOS-5 meeting (2007) on the BLUElink Australia ocean forecasting system, including how such forecasting systems and related models can benefit island and coastal communities across the many spheres of environmental protection and natural resource management. BLUElink (www.bom.gov.au/bluelink) is a contemporary example of emerging global ocean forecasting systems in the Indian Ocean region which provide operational forecasts through both external web sites in graphical format and as digital data sets via ftp servers (http://www.bom.gov.au/oceanography/forecasts).

The basics of ocean forecasting systems was described, as well as their operational characteristics. Actual and potential applications of associated forecast products were outlined, including training and support for prospective IOGOOS users, as it relates to societal benefit, including a focus on relevance to the South West Indian Ocean. An overview was given on the history, current status and future plans for the project. Future developments in systems emerging with applicability for the IOGOOS constituency were also discussed including potential synergies with related ocean observations, process studies and associated modeling / ocean forecasting in the South West Indian Ocean region. To these ends, this IO wide project, which contains an explicit demonstration region area for the South West Indian Ocean being led by Mauritius, has synergies and links with the modeling, observations and applications capacity building themes of the DBCP 2011 Mauritius workshop.

French Contribution to the Observation of Oceanic Processes in the Indian Ocean and their Imprint on Ecosystems

This presentation gives an overview of recent research conducted by IRD and partners in the South West Indian Ocean (SWIO) region in the field of observational oceanography. Different IRD scientific teams operate in the region:

1. EME (Exploited Marine Ecosystems) is involved in the SWIO in: (1) the SWIOFP[1] programme - fishery data base and pelagic fisheries; (2) the EU funded MADE[2] programme –environmental data collection, biology and ecology of sharks, reduction of by-catch by purse seiners, FADs and longliners, development of prototypes; (3) EME also leads the WIOMSA funded MESOBIO[3] programme that includes a strong regional partnership (particularly - but not only - with South African institutes). MESOBIO focus on the imprint of the eddy dynamics on ecosystems of the Mozambique Channel. Examples of results obtained during 3 recent cruises (2008-2010) are presented. They illustrate the eddy signature at different trophic level.

2. The IRD contribution to the IndOOS / RAMA programmes is lead by J. Vialard (IRD, LOCEAN) and consisted of (1) the deployment of a RAMA mooring (8°S – 67°E) in 2007 and its service in 2008; (2) the launch of ARGO floats in the tropical IO in 2005 and 2007 and (3) the acquisition of physical oceanographic data (CIRENE cruise in 2007).

3. Finally, the connectivity between SWIO islands and shelf region is studied for coral fish larvae (P. Chabanet, COREUS, IRD Réunion). The transport of passive tracers is modelled using geostrophic velocity derived from altimetry. The study demonstrates the potential connectivity between Mauritius and Réunion islands.

[1]SWIOFP: South West Indian Ocean Programme

[2]MADE: Mitigating adverse ecological impacts of open ocean fisheries

[3]MESOBIO: Influence of mesoscale dynamics on biological productivity at multiple trophic levels in the Mozambique Channel

EME: Exploited Marine Ecosystem

LOCEAN: Laboratoire d’océanographie et du climat: expérimentation et approches numériques

CoReUs*: Biocomplexité des ecosystems coraliens Indo-Pacifique*

NCEP Weather and Climate Products

The US National Weather Service National Centers for Environmental Prediction Center (NCEP) was represented by Dr. Wassila Thiaw. Dr. Thiaw gave a seminar on the NCEP operational Climate Forecast System (CFS) and also discussed products from the global forecasts system (GFS). The CFS is a fully coupled ocean-land-atmosphere model. Version 1 is at T62 wave number truncation with a horizontal resolution of 250 by 250 km, approximately. Dr. Thiaw also discussed the newly operational version of the CFS, CFS V2 at about 100 by 100 km resolution with improved physics over the CFS T62. System errors in both models as well as forecasts for the tropical Pacific and the Indian Ocean were presented. The CFS reanalysis (CFSR) was also discussed and model analyses compared with those from the NCEP Climate Data Assimilation System (CDAS). The results show agreement between the two reanalyses in terms of the general patterns, but also some discrepancies in terms of the magnitude of these patterns. This clearly shows the need to access in-situ measurements over Africa to validate the reanalyses. Dr. Thiaw showed the participants how to access NCEP data and tools to use to analyze these data sets. Furthermore, applications of the NCEP GFS in subseasonal forecasting with emphasis on the Madden Julian Oscillation (MJO) and impacts on Africa, was discussed.

GLOBE Overview

GLOBE is an international hands-on, school and community-based science and education program that unites students, teachers, and scientists in study and research about the dynamics of the Earth's environment. Over a million GLOBE students in more than 18,000 schools located in over 100 countries have taken important environmental measurements. Their data are used in their own research activities as well as by scientists around the world. More than 35,000 teachers have attended GLOBE professional development activities.

The goals of the GLOBE Program are to:

- Improve science education;
- Increase scientific understanding of the Earth as a system; and
- Enhance the environmental awareness of individuals worldwide.

"GLOBE is the quintessentially ideal program for involving kids in science."
Nobel Laureate Dr. Leon Lederman.

The GLOBE Program is implemented through a worldwide network of primary and secondary schools. GLOBE students learn about their local environment by:

- Taking environmental measurements at or near their schools using GLOBE measurement protocols and appropriate, calibrated measurement equipment.
- Reporting their observations to the GLOBE database via the GLOBE Web site or email.
- Using tools on the GLOBE Web site to create maps and graphs from their own data, to analyze GLOBE data sets, and to share their data with other schools around the world.
- Conducting real research in collaboration with scientists and other GLOBE students worldwide.

GLOBE students have reported over 15 million measurements in the areas of Atmosphere/Climate, Hydrology, Soils, Land Cover/Biology and Phenology. GLOBE improves student understanding by involving students in conducting real science – taking measurements, analyzing data, and participating in research collaborations with other students, as well as with scientists engaged in cutting-edge Earth Systems Science research.

Scientists and educators have developed environmental measurement protocols and educational materials as a resource for GLOBE teachers. Professional development workshops provide teachers with content information and pedagogical strategies to support student research.

Broad international participation is an integral part of the GLOBE Program. Bilateral agreements establish partnerships between the United States and its international partner countries, which are then responsible for designing program implementation in their own countries.

GLOBE students measure and report physical, chemical and biological properties of Atmosphere/Climate, Hydrology, Soils, Land Cover/Biology and Phenology. The resulting global data sets are publicly available via the Web at **www.globe.gov** to users including the worldwide environmental science community. GLOBE students access these data for classroom studies, research, student-scientist partnerships, and worldwide school-to-school collaborations.

GLOBE supports education by providing hands-on experience in authentic science. GLOBE students are doing science, not just learning about the work of others. Students build from the measurement of individual environmental parameters to an understanding of how the Earth functions as a system.

Ocean Observing and an Ecosystem-based Approach to Science and Management by Dr. Rebecca Shuford

The ocean ecosystem is a marriage of the physical, chemical, and biological marine environments. Disturbance to one can cause disturbance to the other. When studying an element of the ecosystem, therefore, it is important to understand the dynamics of that element with respect to the whole ecosystem. Thus an ecosystem-based approach to management (EBM) requires fundamental knowledge of basic ecosystem principles and processes. This will require sustained ecosystem observations and monitoring, process oriented research, and integrative ecosystem modeling which will provide greater basic understanding of ecosystem processes and tools for evaluating the effectiveness of EBM.

There are many societal goals/ objectives and benefits that can be supported through EBM and in turn the application, assimilation, and analysis of diverse ocean observations (e.g. biological, ecological, physical, chemical, socio-economic). Some selected examples of applications and the importance of ocean observations include: ecosystem-based approach to fisheries management (e.g. EcoFOCI); mitigate impacts/ interactions between fishing vessels and protected resources (e.g. Turtlewatch; species hotspots – an application that is extensible to other species and management topics); harmful algal bloom forecasting, monitoring, and mitigation (e.g. HAB-OFS); determination of movement and accumulation of marine debris; improve navigation safety, efficiency of ports and harbors, and ensure protection of coastal marine resources (e.g PORTS®); coral reef health and monitoring (e.g. CREIOS); Climate Change impacts on the ecosystem (e.g. sea level rise, ocean acidification, shifts in SST, Salinity and impact on living marine resources and habitat).

An Overview of Ocean and Coupled Models

The presentation provided a brief introduction to ocean and coupled models and explained how they can be used. For ocean models, results from hindcast experiments we shared where they simulated oceanic conditions of past several decades using atmospheric forcing data. In particular, results from a high-resolution nested ocean model for the Greater Agulhas System region and comparison with various observational data were given. Also, an example of ocean forecasting from Japan Coastal Ocean Prediction Experiment (JCOPE) is presented.

Regarding coupled ocean-atmosphere general circulation models, it was shown their use in seasonal prediction by SINTEX-F1 model. A successful prediction of climate modes (El Nino, Indian Ocean Dipole, Subtropical Dipole Mode, etc.) that induce abnormal weather may help us to mitigate its impact. Also, application in global warming projections by IPCC models in different scenarios, paleoclimate simulations (coupled models are used to simulate episodes of past climate such as the Last Glacial Maximum to help understand the mechanisms of past climate changes), and climate research are presented.

ODT Session, Marine and In-Situ Observations by Dr. Bill Burnett

Due to technical challenges this session became a working session which was thoroughly enjoyed by ODT participants, below are the outcomes of the working session.

What is one question we would like an answer to when it comes to observations?

Questions posed by the participants:

1. What are we going to observe at the surface and in the water column?
2. What can we achieve from the observations?
3. What is the importance of marine observation in the region?
4. What processes can we study?
5. How can we use this data to sustain the marine environment?
6. How do we correlate the remote sensing data with the in-situ measurements?
7. How to make observations in the ocean when piracy is an issue?
8. What are the limitations of these two data types?
9. How do we gain access to the marine datasets?
10. How to get real-time data from in-situ obs?

Questions 1 and 7 relate to “Making an Observation.”

Questions 2, 3, 4, 5 relate to “Societal Relevance of Observations”

Questions 6 and 8 relate to “In-Situ vs. Remote Sensed Observations”

Question 9 and 10 relate to “How to Obtain Observations”

Requirements for marine observations:

It is important to determine the requirements to observe the marine environment before determining what marine platform to use to meet the requirement.

Refers to question 1 and 7.

Weather requirements – To measure wind speed and direction, wave height and direction, and barometric pressure (the top five parameters to measure at NDBC). WMO requires weather observations at 10m. This requires a rather large buoy to get obs at this height and are thus rather expensive. Smaller buoys cost less but don't meet the requirements and users have to interpolate in order to get the data at correct height.

Ocean requirements for surface currents, SST and possibly biogeochemical parameters.

Climate requirement is to observe surface and subsurface ocean temperatures (down to 500 m) and pressure, along with wind speed and direction.

Tsunami requirements for ocean are deep water height.

Platforms that collect observations:

Ships – used for Voluntary Observing Ship (VOS) Program (barometric pressure, air temperature, winds), Ships of Opportunity Program (ocean temperature with depth), and VOSClim (high resolution barometric pressure, air temperature, winds).

Costs = $10,000 USD (order of magnitude cost)

Drifters – used primarily to collect weather observations (barometric pressure), ocean observations (sea surface temperature and surface currents).

Costs = $10,000 USD

Floats – used to collect ocean/climate observations (salinity, ocean temperature with depth).

Costs = $10,000 USD

Gliders (surface and subsurface) – used to collect weather, ocean, climate and tsunami observations.

Costs = $100,000 USD

Ocean gliders – (subsurface). Can be used in piracy regions and where vandalism is an issue. Can store 30 days of data. Uses fins to control direction and depth. Costs about same price as 4 Argo floats. Easy to lose.

Wave glider – user can control where the glider moves and can perform station keeping. This glider has 6 m tether that is attached to fins which are used to power the glider. Not good operating in strong currents. Can attach ocean obs instruments where the fins are.

Moorings – used to collect weather, ocean, climate and tsunami observations.

Costs = $100,000 USD

Most moorings are 3m platforms that cost about $200K and require ship time to deploy - very expensive option.

Goal is to collect as many obs as possible at the cheapest cost but with good quality. Reduce the "cost per ob" as much as possible.

Obtaining Platforms:

Moorings:

Build your own or commercial

Commercial companies: For Tsunami = SAIC, Climate = Wave rider and Seawatch, Waves = Data Wells

Drifters/Floats:

Commercial or build your own

Ships:

Commercial

Gliders:

Commercial

When considering commercial, need to take into account price, quality, experience, data sharing policies.

Considerations when using moorings for wind observations (anemometer):

- Pitch and roll
- Height
- Direction

- Obstruction for measurements
- Birds

Anemometer types:

1. Sonic – marine salts affect measurements over time, only measure up to 30 or 40 m/s, birds like to sit on them.
2. Mechanical – i.e., RM Young – works well but need to ensure proper reference direction, bearings give out frequently.

Actual mooring considerations:

- To keep it in place – chain or nylon
- Taut (all climate moorings) or non-taut (in areas of high waves, strong currents)
- Vandalism (sling-shot fishing, boats attaching to the moorings) – any suggestions to deal with this? – create awareness with the fisherman, place equipment on sea floor, AIS

Communication options – satellite, iridium, 2 way communication has advantage of being able to reset payloads remotely.
Power systems – solar panels, batteries

Payloads – data logger, payloads – collects and "processes" data and then disseminates it.
Buoy design – instrument placement, engineering, technicians, deployment, logistics.

Quality management:
WMO using ISO 9000 standards

1. Need calibration facilities or send to a facility/manufacturer that can calibrate for you (e.g. Regional Marine Instrumentation Center)
2. Documentation standards
3. Training

Making use of ships enables upper air observations to be made over the oceans.

Drifting Buoy Donation Program donates a buoy which can be placed on a ship to collect barometric observations.

Data Dissemination - How do you get the data?

Data transfer:
Weather – GOES
Tsunami – Iridium
Climate – Service Argos
Ships – Inmarsat

Quality control:
Automatic quality control by server does gross error checks, range checks and bit checks.
Manual quality check, requires someone to review the data (minutes, hours or days after collection) to ensure the quality of the data.

Dissemination:
Via web, GTS

Archiving:
NODC

Website: ndbc.noaa.gov

When collecting data, do not change the data. People can accuse you of manipulating it to suit your needs. Instead use a quality flag with each and every observation. Archive the raw data with the quality flag. Also require a quality descriptor so user knows what the quality flag means.

The Agulhas Return Current (ARC) Ocean Climate Station: Drifting and Moored Buoy Data

Dr. Meghan Cronin (NOAA Pacific Marine Environmental Laboratory) spoke about "The Agulhas Return Current (ARC) Ocean Climate Station: Drifting and Moored Buoy Data". As a member of the U.S. CLIVAR working group on Western Boundary Currents (WBC), Cronin was lead author

on an OceanObs09 community white paper titled "Monitoring ocean-atmosphere interactions in western boundary current extensions", a strategy paper that was vetted in an open workshop held in January 2009. WBCs as they extend into the ocean interior are regions of intense oceanic warming of the atmosphere. This heating can lead to stronger surface winds, clouds, deep convection, rainfall both locally and remotely, and frontogenesis that can affect storm development and the storm track.

WBC extensions are also regions of intense CO2 absorption. One of the OceanObs09 recommendations was that an OceanSITES "reference station" surface mooring should be placed on the warm side of each WBC extension system, and that of the proposed new stations, the Agulhas Return Current had the highest priority. Thus, with funding from the National Science Foundation (NSF) and NOAA, and shiptime aboard the FRS Algoa provided by ASCLME, the ARC surface mooring was deployed at 30E, 38.5S on 30 November 2010. Unfortunately, the Agulhas current experienced an early retroflection in January 2011 that caused extremely strong full water column currents at this location. As a result, on 16 January 2011 the ARC mooring nylon broke, several hundreds of meters below the deepest sensor. Like the two "Adopt-A-Drifter" surface drifters that were deployed during the FRS Algoa cruise, the drifting buoy observed a ~2C cooling as it drifted eastward into the South Indian Ocean basin. Of this, 1.5C cooling can be explained based on the net surface heat flux computed from the ARC buoy data. The remaining cooling is likely due to horizontal and vertical mixing.

With shiptime kindly provided by TAAF, the drifting buoy was recovered on 9 March 2011 by the R/V Marion Dufresne enroute to Isles Crozet and delivered to the CNOI shipyard in Mauritius. Cronin arrived several days prior to this meeting to disassemble and ship it back to Seattle.

The SCOR working group 136 is analyzing potential locations that may be better suited for the ARC mooring. For more information on the project and to access the data, see: http://www.pmel.noaa.gov/OCS/ARC/.

ODT: Remote Sensing led by Dr. Graham Quartly

This session covered a variety of aspects of acquiring, plotting, processing and interpreting data from a variety of ocean remote-sensing satellites. This began with an overview of remote-sensing

technologies -- the choice of frequencies (according to which parts of visible light, infra-red and microwave can pass easily through atmosphere, and of what information each frequency conveys about the ocean surface), the resultant effects on instrument resolution, the choices of orbits (mainly geosynchronous or a low-earth orbit approaching the poles). Secondly the presentation covered data provision, giving a number of FTP sites or web pages from which useful data could be downloaded for free. With these many sources of available data, the point was made that for individual researchers, the choice of appropriate satellite instruments and products would be different according to their application e.g. detailed local picture or global view, immediate (in near real-time) or a delayed fully validated product suitable for climate studies.

A number of software applications were discussed, with the speaker pointing out that the key requirements are to be able to read in data in a variety of formats (although NetCDF is by far the most common nowadays), to allow some basic processing (sub-selection of data from a region, compositing or differencing different fields) and to be able to generate clear well-labeled plots both on screen and to graphics files. Matlab has become an ipso facto standard, but is expensive. A number of alternative free software packages exist, but have deficiencies in functionality compared with Matlab. Some time was spent installing Octave (a Matlab clone) on many of the trainees' laptops, but there was not time for them to have a go at the practical exercises that had been constructed.

These practical exercises included reading in data from the various common formats, applying flags and smoothing the data (to remove the smallest scale structures). More advanced exercises related to the choice to be made in development of cloud mass, the construction of composites and the calculation of anomalies relative to a seasonal climatology.

Finally, we discussed means of visualising chlorophyll data (using logarithmic scaling), time series (via multiple plots or Hovmöller diagrams) and combining SST or SSH with chlorophyll patterns (by adding contours onto a coloured plot). As there had not been time for practical exercises during the class, those who were interested were given the PPT presentation and sample datasets to allow them to attempt some of the exercises once they had returned to their own institutes.

Regional National Met/Ocean Institutes' Marine Data Requirements by Ali Mafimbo

The known science in the Western Indian Ocean is that the maritime environment strongly influences our weather and climate and the heat fluxes over the region's ocean play an important regulating role in both the sea surface temperatures over the ocean and the weather and climate. Statistical teleconnections between SST anomalies and precipitation over Region have been demonstrated and highly documented. However huge gaps in knowledge in our understanding of ocean-atmosphere coupling mechanism in the ocean region adjacent to the Somali current exist. We need to calibrate satellite detected meteorological parameters, improve air-sea interaction parameterization in the current numerical models, enhance knowledge of the turbulent fluxes to describe the structure of the lower part of the Marine Atmospheric Boundary Layer (MABL) where interaction between the atmosphere and the ocean takes place. A number of data streams including SSTs, Temperature profiles, Sea Level Pressure, Sea Surface winds (Direction/speed), Air Temperature, Humidity, Wave (spectral density, height and periods), Sea level data, Surface currents, Current profiles, Temperature profiles, Sea Level Pressure, Sea Surface winds (Direction/speed). These streams will the required for 1) Real-time Ocean observation to calibrate/validate both modeling and satellite 2) Monitor ocean atmosphere fluxes and the Somali current "gyre" over the upwelling region of eastern African Coast 3) Investigate the correlation between intra-seasonal dry and wet spells and the propagation of MJO oscillations. 4) Enhance the understanding of the Indian Ocean Dipole 5) Investigate the shifting convergence zone of the EACC and the reversing southern Somali current.

ASCLME Observing and monitoring efforts; Lucy Scott and Tommy Bornman

The ASCLME has supported 20 surveys throughout the South-Western Indian Ocean (including the Mozambique channel and East Madagascar current) between 2008 and 2010. Surveys took place in collaboration with several other programmes such as the EAF Nansen Programme, IRD, IFREMER, NIOZ, NOAA and ACEP. A wide range of state-of-the-art *in-situ* instruments from various were international programmes and initiatives were deployed during these cruises, including:

- Long-term Ocean Climate Observations (LOCO) moorings
- Three Atlas moorings along the 55°E longitude as part of the Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (RAMA) network, together with NOAA PMEL.

- 13 NOAA Argo floats have been deployed
- Five satellite drifters were supplied by NOAA as part of their "Adopt-a-drifter" programme and were adopted by South African schools.
- An Agulhas Return Current (ARC) reference station (OceanSITES mooring) was deployed at 38.5ºS and 30ºE
- ASCLME assisted in the retrieval of the two CPIES moorings, to get a first quantitative estimate of the regional dynamics and variability of the SAMOC.

A review was given of nearshore sampling and survey activities, as well as the basis for nearshore long term monitoring which has been established by the participating countries of the ASCLME project. This includes:

- Inshore oceanography, invasive species and pollutants training course
- Coral reef, seagrass and mangrove high resolution mapping (partnership with IRD)
- Hydrodynamic connectivity and dispersal modelling of fish larvae
- Addition of an Underwater Temperature Recorder to the regional UTR network.

For purposes of ongoing long term oceanographic monitoring, two annual cruises are proposed.

1) LOCO and Atlas mooring cruise to Madagascar and the Mascarene Basin, ARGO and drifter deployment as well as environmental stations.

ARC OceanSITES and CPIES mooring cruise to the Agulhas Return Current, ARGO and drifter deployment as well as environmental stations

Adopt a Drifter Programme

The National Oceanic and Atmospheric Administration (NOAA) Office of Climate Observation established the ***Adopt a Drifter Program*** (www.adp.noaa.gov) in December 2004. As part of this Program, teachers and university professors across the globe, along with their students, are invited to co-adopt a drifting buoy with educators and students in the United States. This program provides teachers with the opportunity to infuse ocean data into their curriculum. A drifting buoy (drifter) is a floating ocean buoy equipped with meteorological and oceanographic sensing instruments linked to transmitting equipment where the observed data are sent to data collecting centers via satellites. An initial global array of 1250 drifting buoys was completed with the official launch and celebration of the 1250th buoy deployment from Halifax Harbour, Nova Scotia, on

September 18, 2005. Ongoing deployment of drifting buoys continues to be essential to maintain the array at its complete level.

Drifter data are used to track major ocean currents and eddies globally, ground truth data from satellites, build models of climate and weather patterns, predict the movement of pollutants dumped or accidentally spilled into the sea, and assist with the forecast path of approaching hurricanes. For scientists and students, it is important to understand how the data are measured, how often data are downloaded, and what data are available for schools and the general public to access. Through the ADP, students have access to their adopted drifter's data (e.g., latitude/longitude coordinates, time, date, sea surface temperature) in near real-time as well as data from other select drifting buoys deployed as part of the global ocean observing system. Students can access, retrieve, and create a time series plot of various subsets of drifting buoy data (e.g., SST). They can also track and map each adopted drifting buoy for short and long time periods (e.g., one day, one month, one year).

In partnership with the University of Mauritius, GLOBE Africa facilitated the collaboration between Okemos High School, Michigan, USA and Belle Village State Secondary School, Port Louis, Mauritius and the subsequent deployment of the three buoys. The deployment party was addressed by NOAA Deputy Administrator Dr. Larry Robinson who expressed his sincere gratitude and appreciation towards all for making these opportunities available for tomorrow's scientist.

Agulhas Current dynamics under Contrasting Climatic Boundary Conditions of the Past

Rainer Zahn and GATEWAYS project members

The marine paleoclimatology of the larger Agulhas Current regime is investigated analysing the sediments that underlie the Agulhas Current, its retroflection immediately South of Africa, and the return current back into the Indian Ocean. Analytical protocols include a range of organic and inorganic geochemical methodologies, stable isotopes, trace element geochemistry and micropaleontology and paleontology. The collaboration of these fields is combined in the 'GATEWAYS' project that is funded by the European Commission and coordinated at the Universitat Autònoma de Barcelona, Spain (www.gateways-itn.eu). The multidisciplinary research combines physical oceanography, ocean and atmospheric modeling, and marine and terrestrial

paleoclimatology. The aim is to (1) test the sensitivity of the Agulhas Current to changing climates, (2) assess the impact of the current on climates in southeastern Africa, (3) examine the sensitivity of the Atlantic MOC to Agulhas leakage, and (4) determine the influence Agulhas variability on North Atlantic and European climate. GATEWAYS offers interdisciplinary training and capacity building to 15 Early Stage Researchers and three Experienced Researchers.

Initial paleoceanographic data profiles into variations of the Agulhas Current and leakage during the late Pleistocene glacial-interglacial climatic cycles indicates that a connection with the Atlantic MOC existed in the past. Salt water anomalies maximised episodically at the tip of Africa suggesting the existence of Agulhas Leakage maxima. The maxima coincided with a progressive strengthening of the MOC that is indicated by geochemical evidence, suggesting a direct connection between Agulhas Leakage and the MOC. Synchronizing the Agulhas paleo-records with similar records from the North Atlantic region indicates that climatic changes there coincided with Agulhas Leakage events in the past. Current work includes detailed analyses of sediment profiles from the Limpopo and Zambesi sediment fans to extract indicators of land climate and vegetation changes in the past; fine scale data profiles are established at the Davie Ridge, northern Mozambique Channel, off Durban and Port Elizabeth, and at the Agulhas Bank and Agulhas Plateau to achieve a fuller picture of Agulhas Current variability, its role in eastern and southern Africa continental climate variation and the variability of Agulhas leakage into the South Atlantic.

A key session during the week was the science and resource planning morning, led by SCOR (Lisa Beal) and ASCLME (David Vousden) whereby the regional scientists also had a chance to give overviews of country activities (Juliet Hermes). These ‘pop ups’ are available on the website and the SCOR science planning document will be made available to those interested. The science and resource planning engaged all participants to identify what observations, cruises, remote sensing and access to model data was needed and why. This was a very fruitful discussion and the minutes can be found in Appendix 2. Key outcomes were:

Recommendations for sustained observations in SWIO.

1. Agulhas System air-sea flux buoy
2. Long-term monitoring of Agulhas Current (transport and water masses)
3. Reference mooring in Mozambique Channel (leveraged on existing 10 year time series)

Recommendations for modelling in SWIO.

1. Improve capacity of both running and analysing models
2. Provide real-time data assimilation products of the western Indian Ocean to help monitor the data sparse area

A full list of trainers and trainees can be found in Appendix 3.

Conclusions

The workshop created a platform for country representatives to network amongst each other and to share the lessons learnt from each other's experiences. The discussions were open to all and they sparked unencumbered and constructive debate. After a productive week of instruction and information sharing, the workshop was closed late on the afternoon of Friday 6 May. Thanks were conveyed to organizers, facilitators and participants for the time and effort that went into making the workshop the success that it was.

Kenya indicated that they would like to host the third in-region capacity building workshop. A small organising commiitee team was set up to assist with the arrangements which should be completed by September 2011 for approval by the annual DBCP XXVII Executive Board and CB-TT meetings. The team will consist of, but not limited to, Ali Mafimbo, Charles Magori, Nick D'Adamo, Johan Stander, David Vousden, Lisa Beal, Augie Vogel, Bill Burnett, Wassila Thiaw, Juliet Hermes, Mike Roberts, M. Ravichandran and Sidney Thurston with warm invitation for those Colleagues participating in Capetown and Mauritius to also please join us in Kenya for MDT, ODT and ADT.

Appendix 1: Workshop Photographs

Figure 3 Participants of the Second DBCP In-Region Western Indian Ocean Capacity Building Workshop

Figure 4 Workshop Opening Speakers

Figure 5 Dr. Larry Robinson, NOAA Deputy Administrator, and Mrs. Leyla Tegmo-Reddy, the UN Resident Coordinator for Mauritius and Seychelles, sign an agreement for cooperative scientific and technical collaboration between NOAA and nine African/Indian Ocean States

Figure 6 Dr. Larry Robinson Presents the Keynote Address
"NOAA's Engagement in the Indian Ocean Region"

Figure 7 Mauritius Global Learning and Observations to Benefit the Environment (GLOBE) Students Prepare to Deploy a Drifting Buoy

Figure 8 US National Marine Fisheries Service Dr. Rebecca Shuford Enjoying Some Pre-Drifter Deployment Moments With GLOBE Students

Figure 9 SCOR-136 Scientists Visit Mauritius Oceanography Institute

Appendix 2 Unofficial Workshop Session Minutes

Non-official minutes of key discussion sessions of 2nd DBCP In-Region Western Indian Ocean Capacity Building Workshop, Mauritius 2nd-6th May 2011, kindly provided by Juliet Hermes and Tomoki Tozuka with no responsibility for contents or errors.

Wednesday morning: Science and Resource Planning
Science Planning (Beal, Biastoch, Hermes)
0910-0920 (1) Show map of existing observing systems, briefly introduce them, and invite audience to add anything missing. Concentrate on time series measurements and repeat measurements - i.e. measuring systems that might set a precedent for future monitoring. Include palaeo
0920-1005 (2) 45 minutes of 5-minute "pop-ups" by regional scientists describing their research in the region (with previously submitted slides to streamline process). This is towards knowing the existing regional observing resources.

- Recap on current observations in the SWIO – measuring systems that might set a precedent for features/locations for future monitoring including paleo
- Hear from regional scientists – towards knowing the existing regional observing resources

Lisa Beal put up a slide from SCOR's nature paper (Figure 9.) and went through the various observations, including sea level rise, paleo, LOCO.

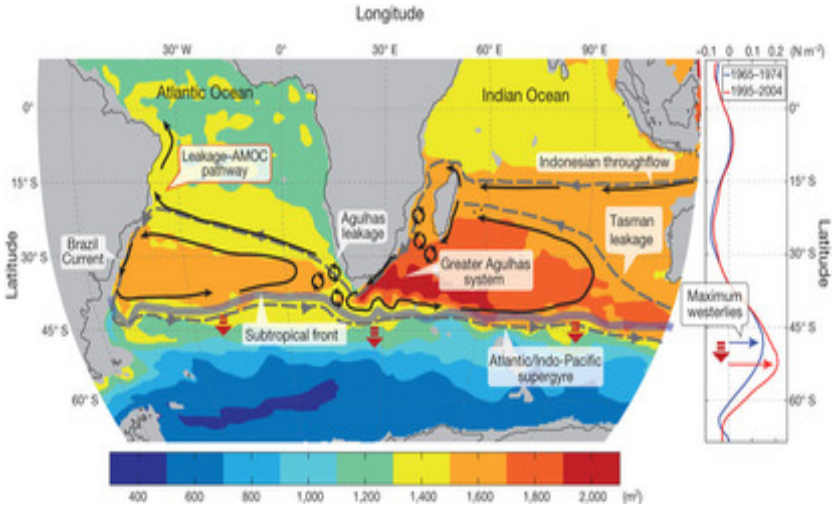

Figure 10 Schematic of the greater Agulhas system
Embedded in the Southern Hemisphere Supergyre

Mike Roberts mentioned all of the UTRs to create a long-term data series and also to investigate physical processes on the shelf edge

Charles Magori – tide gauges in Kenya - 1 in Mombasa since 1986 and Namu in 1996 however data not really continuous, some gaps due to breakdown. But data in hourly values and monthly means. GLOSS

Ali Mafimbo from Kenya has GLOSS tide gauges but also country tide gauges since 2004 tsunami throughout coast – 4 which were installed in 2007 run by met office. Data doesn't reach international community as not linked to satellite **–** perhaps DBCP can look at how to make this data reach community

Will de Ruijter – old map in office showing a telephone cable between Mozambique and Madagascar from 100 years ago, you might be able to connect this tuning to variations in transport in the channel. Is the data available?

Mohammed Ngwali from Tanzania, 2 gauges, 1 in Zanzibar and 1 in Dar el salam (since 1985, not continuous) This data also goes to the GLOSS. It shows that for Zanzibar sea level is falling

Isabelle Ansorge (UCT) –mentioned regular transects down to Marion Island from Cape Town with XBT lines, she would like to propose that this monitoring becomes regular**.** Start in 2013. This is different from Good Hope line. Problem is logistics, previously was a platform for honors students. Need to pool equipment, it is underway so underway ADCP but no time to do CTD. Will have 75khz. Problem is that there are never enough people to go to sea.

There was a discussion around meteorological measurements which are done automatically onboard (radiosondes and 3-6 hour measurements)

Gary Brassington– long records with regards to remote sensing with satellite altimetry going back to 1992 – is this well disseminated, are the group able to access this?

This links back to AMESD, do the regional scientists know what the products are and where to find them. Graham Quartly will discuss this in his ODT session.

Herman Ridderinkof – Highlighted that there is room available on the NIOZ mooring service cruise in the Mozambique Channel, which is done yearly. Further things can be added on such as underway measurements – i.e. more sea time available on SA's Algoa from Durban. Transit and some time once there to do additional measurements.

POP up 5 mins slides (see website):

1) **Juliet Hermes** South Africa: Juliet@saeon.ac.za

2) **Johan Stander**, South African Weather Service: johan.stander@weathersa.co.za
Are other meteorological agencies performing similar operations?
Ali – other met offices are doing this but not at the same level SA. Kenya is trying to build up marine meto services, liaising with NOAA, also designing observations network. Cooperating with US Navy with wave product. Interest is to really understand fluxes over upwelling regions.
Meghan Cronin – with ARC surface mooring, data will hopefully go onto GTS including barometric pressure. As a reference station mooring, the real value is in assessing the model products. Caution should be taken in using the assimilated data. For forecasting, it is important to use all data available. In reanalysis this is different and it is important to withhold the data.
Mohammed Ngwali – we are not taking marine measurements, using marine products for providing weather forecasts
3) **Pierrick Penven and Issufo Halo -** pierrick.penven@ird.fr – described the safe configuration and highlighted some PhDs, including that of Chang, Veitch, Halo etc.
Meghan asked about coupled fisheries modelling and Pierrick described how the driving force behind ROMS within South Africa has initially been for fisheries. IRD working with UCT started with fisheries model for Benguela. Collaboration with IBM and ecosystem modeling - following individuals. Approach of flux of energy. Has been used for Tuna. Modelling in Mozambique Channel: nested zoom (1/15°) to look at eddy formation and propagation, vertical flux of biogeochemical to look at impact on ecosystem. Modelling for Agulhas Current and Leakage: mode idealized experiments such as slowing down of Agulhas Current.

4) **M. Ravichandran – (**ravi@incois.gov.in) – India – IndOOS – deploy ARGO floats 10 every year. Operate boat for 4 XBT lines. RAMA about 60 days ship time per year. 35 tide gauge stations with 3 stations for more than 100 years. Operate 8 ADCP moorings. Monitor physical and biological sub surface properties. Data is available upon request.

5) **Charles Magori, (**Kenya cmagori@yahoo.com) Sea level Monitoring in Kenya
The Intergovernmental Oceanographic Commission (IOC) of UNESCO developed a Global Sea Level Observing System (GLOSS) program in 1985 to address the growing concern about the rise in mean sea level around the globe. Through GLOSS, a network consisting of about 300 tide gauges have been installed throughout the globe. Kenya is one of the countries that is actively participating in GLOSS and has received assistance from IOC in terms of provision of equipment and capacity building.

There are two tide gauges along the Kenyan coastline. Both Mombasa and Lamu gauges are principal stations on the GLOSS network and transmit data in real-time. The two stations are also dedicated components of the Indian Ocean Tsunami Warning System (IOTWS). Sea level data from the 2 stations (and others like them in the region) can be used to either confirm or cancel a tsunami warning throughout the region.
The objective of this report is to provide an insight on the status of sea level monitoring in Kenya. It gives a description of the historical and current status of the sea level network in Kenya, availability of data from stations, as well as scientific and technical capacity available in the country. The report also presents the results of harmonic analysis of time series of sea level data and tide predictions for ports of Mombasa and Lamu.

– 2 tide gauges. Operated by KMFRI – 4 tide gauges. Support from IOC/UNESCO. Originally 2 gauges were to monitor sea level rise in Indian Ocean region. Since 2004 Tsunami, being used for real-time for Indian Ocean Tsunami Warning System (IOTWS). Available free of charge. KMFRI – mostly near inshore research. Lack of vessels to go further offshore. Major setback=pirates. ASCLME would provide opportunity for further offshore, but pirates a problem. Rely on ships of Opportunity, special expeditions and ASCLME. East African Coastal Current – (tidal expedition 1993) – looked at it offshore, mostly surface currents affected by monsoons – only looked at 1 season. Piracy getting worse and going further south, so becoming more of a problem. Development of sea level web site for Africa and studies on East Africa Coastal Current.

Kenya Met Office – doing same obs as SA but at different levels. KMS- building up marine obs, talking to NOAA for drifters. Cooperate with US navy to get a product from them to issue to mariners in their oceans. Trying to understand fluxes over upwelling regions with Somali guys. Believe fluxes influence climate.
Meghan Cronin– ARC surface mooring – want to get data onto GTS to compare barometric data. As a reference station – assess model products – if assimilated into the data, then it will not be an independent data. For forecasting, want to make use of all available reference data.

Tanzania Met Office – not taking marine met data –using marine products from associates for forecasts.

6) **Arshad Rawat (**arshadra@yahoo.com) Mauritius Oceanographic Institute (already presented so summary included here for completion

7) **Ahmed Abdoulkarim,** Oceanographic Data Manager: a_abdoulkarim@yahoo.fr
Comoros – tide gauge, first one started last year (UNESCO) and monitored by met service (part of warning system). Main activity=marine atlas (ODINAFRICA). No research vessel to do expeditions. No in-situ data measurements. Atlas uses downloaded data. Coral reef monitoring and collaborate with fisheries and ASCLME cruise coordinator.

8) **David Obura** (dobura@cordioea.org) & Denis Macharia (dmacharia@cordioea.org
CORDIO– based in Mombasa, but CORDIO more than just KENYA. Focus on biodiversity in reefs. From 2007, coral bleaching alert. Partnership with IOC – reef assessments. Regional projects – trying to investigate biogeography. May have high biodiversity hotspot in the region. Main focus south of Tanzania towards N. Moz. Analysing datasets all together to define biodiversity.

9) **Avelino Langa (**avelinolanga@yahoo.com.br**)**
– Mozambique – MSc project – IMS in Dar – Influence of eddy variability on primary production in Northern Moz channel.

10) **Emidio Raul Andre (**erandre01@hotmail.com) – Mozambique – Data collection in Moz, subsurface mooring in Pemba 2007. Serviced once a year ago. Now have problems servicing because of piracy. Every year cruise on Sofalla Banks with shrimp fisheries for more than 10 years now. Small coastal monitoring activities – addressing coastal systems and bays. Other institution – Institution of Hydrography – network of tide gauges. Perhaps more than 10 years of data.

Herman – Can possibly assist with servicing the mooring off Pemba. David Vousden – service along with LOCO moorings, ATLAS moorings etc.

11) **Jean Francois Ternon,** IRD France jean-francois.ternon@ird.fr Summary for completion, presentation already given

12) **Khaled** (kzubier@kau.edu.sa OR khalid.zubier@gmail.com)– Saudi Arabia – lack research vessel. Development of coastal monitoring system – wave monitoring system in Red Sea. Various research projects with partners

13) **Maged Hussain – (**Maged_hussain1@yahoo.com) Egypt
Mediterranean coast surface current observation for 2006-2011.

14) **Siri R.jayasekera (**jayasekerasiri@yahoo.com) Sri Lanka – Tsunami warnings. Onset of the southwest monsoon. Marine weather forecasting. Marine weather branch from July 2011. Seasonal forecasting.

15) **Rifath Naeem – (**rifath.naeem@gmail.com) Maldives – Environmental Protection Agency – no modelling or ocean monitoring. Data stored with coast guard, met office, and international collaborators

16) **Tafesse Regasse Gurma,** Federal Democratic Republic of Ethiopoa (tafesseg@yahoo.com) – there are 9 Ethiopian commercial ships which could be used as ships of opportunity, their main voyages are through the Indian Ocean (e.g. to Australia). Looking for international help to provide instruments for SOOPs. IXIRF and MM5 models are run to produce weather forecast.

17**) Dr Gary Brassington, (**g.brassington@bom.gov.au) Australia – Bureau of Met provide operational framework: BLUE LINK since 2007. Lot of funding from Navy. Need to pull all resources to build up good operating system. Bias towards Australia, but going to global 1/10 model from June 2013. Want to draw on expertise from WIO to assist with forecasting products for whole basin. Can pool questions and resources. International groups involved such as GODAE, INCOIS. Meeting in Oct this year. Another team = JCOMM, achieving best practices and standards. **Anyone validating SST in the region??**

18) **Razafindrainibe Hajanirina: (**hajanirina.sage@blueline.mg) Madagascar – Not researching as deep as they would like to. National office of Environment – handling house for data. Tulear institution main place for training and capacity building. Also in charge of training oceanographers. Not many working on ocean obs, even though big island. Most work on biological oceanography.

Physical oceanography - not much focus, although ASCLME helped with this. NODC, John Bemiasa – data processing and handling – fluid dynamics, main person who handles the data. Supposed to gather all the data. Last research vessel is now not operational. Have been sending data to Hawaii for global processing? Need infrastructure before tide gauge can start and thinks it would begin in Tulear in south. Ministry of fisheries – focal point for SWIOPF, fisheries resources variability. Facing each year algal blooms – causing problems with fisheries and humans. Usually Jan/Feb. This year in April. What is the cause – SST? Willing to actively participate in cruises in the area.

David Meldrum – Easy to deploy drifters, just toss overboard. Data goes into GTS. Very valuable long-term data.

19) **Dr Hemanaden Runghen: (hrunghen@moi.intnet.mu) Mauritius** – Made a presentation on "First Step Towards ROMS Operational Forecasting on the Exclusive Economic Zone of Mauritius" ABSTRACT: The provision of information on oceanic parameters is crucial when addressing issues such as fisheries, environmental impacts, pollution and marine operations. In this context, the Regional Ocean Modelling Systems (ROMS) is used to provide forecasts information on circulation variability (current), temperature, sea surface height and salinity over the Exclusive Economic Zone of Mauritius. The necessary data, hardware and software requirements for implementing the system are addressed. A climatology analysis run shows that ROMS resolves the major oceanic processes over the region of study at a horizontal grid size of $1/10^{o}$ (approximately 10 km) and with 35 vertical levels. ROMS is used to carry out 5 days forecasts on region. Data for initial and lateral boundary conditions are obtained from a global ocean models (Mercator) while surface forcing conditions are obtained from global atmospheric models (GDAS and GFS). These data are retrieved via OpenDAP. For operational purposes, a script runs ROMS forecast everyday in batch mode using crontab and outputs of the result can be viewed on a web page. Some possible improvements have been identified such as the use of nesting method to make forecasts at higher resolution and validation/calibration strategies using in situ data such as Argo floats.

Resource Planning (Dr. David Vousden)
1130-1145 (1) Two or three slides showing A. who are the partners currently confirmed in terms of our long-term monitoring/observations programme for the WIO (e.g. NOAA, NIOZ, IRD, ASCLME, SWIOFP, WIOMSA, AMESD, etc), B. What we were planning to do in terms of both offshore and nearshore ecosystem observations and maintaining the 'early warning' network and then C. how we are now trying to move (at the request of the countries) toward a broad but formal WIO Alliance of countries and partners for Ecosystem management and governance that would include an ' Alliance for Science' to maintain and expand (where possible) our monitoring and observation network in the WIO region.

David gave a presentation

ASCLME-NOAA agreement (its content will be posted on ASCLME web site)

Partners for 2011 cruises and beyond:

Confirmed: ASCLME, ACEP, SWIOFP, NOAA, Royal NIOZ

Expected: IRD, FAO (Nansen project)

Funding of vessels still to be negotiated and confirmed.

Cruises undertaken to date (2008-2010): East Madagascar, Mauritius, Seychelles, Mozambique Channelx3, northern Mozambique Channel, and Agulhas

Need to identify other long term monitoring projects: SEC, EMC, dipole eddies, Comoro gyre, Mozambique eddies, Agulhas Current, Agulhas Retroflection, Agulhas Rings, Agulhas Leakage, Agulhas Return Current? What are the scientific interests?

Proposing 2 cruises a year. First – 40-50 day, service LOCO and ATLAS, service and expand UTR network, deploy ARGO, deploy Sat drifter, selected sampling sites (CTD, plankton, fisheries etc.) Plan not set yet, and need to see piracy activity at the time.

Mike Roberts – suggest another ATLAS mooring further south on 55°E line, may be north of La Reunion. (ATLAS moorings = Meteorological observation, surface current, and temperature to 500 m and sometimes ADCP). To observe South Equatorial Current, but perhaps ATLAS mooring is not the best option??

What do they measure? Air sea flux and surface current and temperature down to 500m
6000khz ADCP for 40 m but only equator
So mike wants something more designed to measure SEC.
Maybe best not to focus on expanding marine meteorological moorings.

Needs scientific justification. NOAA may think about it. NOAA has a great interest to the region.

SCOR – wants to develop science plan to take to Indian Ocean Panel IOP-8 in Chennai India 25-26 July 2011. Scientific questions proposed, and needs to answer these put forward. Not only for the region, but needs global impact. By Friday, need a list of important questions and proposed sustained observations to be proposed.

Ravi and Will: members of Indian Ocean panel. require statement with relevant scientific questions. With a proposal for sustained observations which we think is important. The variation in ITF (key component of global climate and ocean circulation) is observable in the Mozambique Channel.

Nick D'Adamo suggested 1 page scientific document with new mooring sites included in the INDOOS map for the INDOOS. IOP8 and Indian Ocean Resource Forum (IORF) in Chennai, India on the last week of July. Invite a SCOR representative to attend.

Lisa Beal – what about putting ADCPs on the existing ATLAS mooring on 8°S and 16°S, which are located in the core of SEC??

Escort from Seychelles coastal guard allowed to maintain 8°S mooring.
Cruise 2 south of Africa, Where should an Agulhas monitoring system be?
Potential to buy into SANAP and therefore get ships time to perform cruise 2

Second cruise – 25-30 days – CPIES and ARC. Need to secure funding for ARC mooring before can be deployed again. ARGO floats and satellite drifters and sampling at selected ecosystem stations (CTD, plankton, fisheries etc.) Establish a long term monitoring program? Needs to be defined and decided upon where and how. No guarantee on ship's time yet

Isabelle – possible to use new ship to assist with ship time (would have all necessary equipment). Would have to go through SANAP program. Best would be Marion Island trip.

Slide from David Vousden

1) summary of science planning session
2) feedback from existing partners and any potential new partners in terms of funding, timing, equipment, sustainability
3) does the data we are collecting fit the needs of the countries
4) where do we go next in terms of finalising agreements and commitments to these two annual cruises
    a. agree on who will be responsible
    b. adopt a mechanism for communication and coordination between alliance partners
    c. target potential funders and valuable new partners through a campaign of "awareness". ASCLME acts as a catalyst.

What do the scientific groups feel is important? Potential new partners?

Are we doing the right science? How do we formally put down an agreement to move forward?

Alliance idea – need to find international funding, and will help for national funding.

Herman – Will help to get National funding as well. Scientific goals – measuring for 10 years, have pretty good idea, but interannual variability? Not shown in the models at present. Would be good to add biological observations. Would be good to compare with variability in Agulhas Current, so would like to see the Agulhas monitoring being done by Lisa to continue.

Rebecca – Supports biological and ecological components as should be included. Need to make sure we collect the right data, but also that it is easily accessible to those users in the community who need it. More capacity building for accessibility is important. To make sure it is actually being used.

Sid – Need to also keep track of the remote sensing at the same time. Funding – Divisions of climate office of NOAA - OCO office (responsible for RAMA) and Research Division.

Graham – UK is also interested in the area. Proposal to get funders to look at biology in SWIO, specifically south of Madagascar. Interest in algal blooms in early year. Interested in deep ocean biology, carbon export, and nitrogen fixation. Anyone interested to look at higher trophic levels? Putting in a proposal, but looking for collaborators. Ideal to tag onto existing ship cruise. Possibility of gliders, especially near Reunion.

Nick – Key issue for all constituents – understanding of marine natural resources. Larval movement knowledge. Eco tourism. Monitoring and prediction of sediments in lagoons and coral reefs. Do we feel like the observing network will lead to better predictions of threats, oils spills,

rescues, etc.. Are the participating countries and beneficiaries clear on what is trying to be achieved by this program?

Ali – Northern countries, know the problem of piracy, but monitoring of Somali current is very important socioeconomically. How can we get around the piracy? What other methods can we use? Number of requirements, but also need to engage with policy makers to ensure that monitoring of that region is made possible. David responded that this is being planned and addressed.

Lisa – Make sure this is in the Science Plan

Juliet – Mike Lucas approved NRF funding for the next 3 years to work on N2 fixation rates in the SW Indian Ocean; specifically south of Madagascar and to the east. Project is linked to an Australian proposal on N2 fixation headed up by Prof Anya Waite of UWA (Perth) to work in the eastern part of the Indian Ocean on the same latitude as Perth. Plans are to run cruise(s) in 2012, 2013. GEOTRACES have transects and process studies in the Indian Ocean - check out their website. A transect cruise from RSA to Australia is planned for the end of this year. I'd like to involve GEOTRACES in my planned cruise and perhaps see if I can get it approved as a Process Study.

David Meldrum – Oil and gas companies, possible co-sponsors and funders? Meeting soon in Mauritius. Indian Ocean Oil and Gas Forum. Someone from here should attend to make contact and possible collaboration. Would need to do environmental surveys etc.

Mike – Ship limitations – Algoa – actually a trawler, 30 years old, converted and refurbished, excellent for mooring and can work in shallow areas, very versatile, but limited CTD capabilities, only 1000m of cable, needs bigger winch for more cable, need external pressure to push the necessity, 75kz ADCP, and Antea – limited for moorings but good for surveys

Herman – everything else is great on Algoa, but CTD cable, but can bring own mobile winch and CTD to do deeper sampling (5000m) - in a container. Box cores and multi cores possible to do. Problem may be speed at which winch can be “dropped”.

Ian wanted to know about cores and Algoa doesn’t have a fast winch, but Herman said that with the winch algoa has it is possible.

ACEPIII
Mike – going into phase III of ACEP. “Luggage/suitcase” idea of biology transport. Similarities found between Madagascar and South Africa biology. Focus on oceanography that transports the biology across from Madagascar to South Africa. To become active in 2012. Synergy possible with Graham.

Will – Prepared to help with proposal.

David proposes that for now ASCLME leads the communication and coordination between Alliance partners. No objections given. If Alliance supported and driven by the countries, more likely to get international support and funding. Also, should be possible to service mooring in Pemba

This was supported by Will and Herman.

Thursday evening discussion summary by Mike and Lisa

- Overview of what's out there and plans
- What do we need to monitor in the Greater Agulhas System?
  - Leakage (Big problem)
  - Interannual variability (fluxes, water masses)
- What is affordable? e.g. LOCO down size, ACT to SSH.
- Wil and Lisa pass recommendation to IOP
- Working towards glider observations in EACC/Somali Current
- Multi-scale (shelf-Greater Agulhas System) – for ship operations, resources, funding – Mike/Isabelle/David.

Friday 6 May Applications Development Team (ADT) Session notes

GP: Graham Patchell (SIODFA)
MH: Mira Hurbungs (Mauritius)
AA: Ahmed Abdoulkarim (Comoros)
KG: Ketsia Georges (Seychelles)
HR: Haja Razafindrainibe (Madagascar)
AM: Ali Mafimbo (Kenya)
DV: David Vousden (ASCLME)
ND: Nick D'Adamo (IOC/UNESCO)
YS: Yohanna Shaghude (Tanzania)
LS: Lucy Scott (ASCLME)
JS: Johan Stander (SAWS)
CM: Charles Magori (Kenya)
MR: Mike Roberts

DV introduced the session – capacity building for DBCP

The floor was opened for discussion on five main topics:

1. Capacity building for data collection (training and skills)
- Establishment of programmes
- Training within institutions

AM: Clarification – is this training long-term or one-off? Response: One off training not way to go; needs to be train and retain; sustained training – Institutional level training as opposed to individual level training (train institutions themselves)

AM: organisations like WMO have training institutions at regional level and these are institutions we could focus on; e.g. WMO has an office in Nairobi, and we could fit in with their training programme.

DV: Yes, longer term training is more desirable. Could also link in with EAF Nansen Program training as they have a lot of expertise.

ST: Repeat training is the aim of DBCP

GP: We should focus more on the interpretation and analysis of data. One day at sea requires 3-5 days of interpretation and processing.

LS: IODE Office in Belgium might be another useful training link.

ND: Yes, agreed, the IOC and IODE provide some very useful training opportunities for marine data and there are other international organizations that could assist this group. As a group, we could approach international supporters to provide, for example, gliders, training and support. We should think about some significant partners over the next two hours.

DV: Agreed, we should put together a concept proposal to send out. We could possibly do this as the Alliance, and the ASCLME would be willing to facilitate this. D. Meldrum has offered a glider from his institute and based on what we get from the DBCP meeting, we can develop such a request/ proposal.

ND: Strongly supports the idea of the alliance, but we should acknowledge existing alliances eg GOOS Africa, IOGOOS

DV: We're not trying to construct something new, but rather tie interest groups more closely. Are people happy with ASCLME facilitating development of this alliance, so we can move forward.

HR: Also supported the Alliance as a concept and would wish to see ASCLME move this ahead

MR: Also very supportive of the Alliance concept as we do need something to improve coordination and bring things together

ND: GOOS is trying to improve an observing system in the IO, so there are some linkages already, though ND does agree with Mike.

MR: This meeting has a very strong socio-economic focus, was this intended?

ST: Yes, this was planned since the last meeting in Cape Town. It can't just be scientific research – it is important for users to be involved. Started with observations, modelling, then also discuss the applications. It's not just a science and modelling workshop, we also need to know what is important to the region.

MR. Noted the change in emphasis since the first DBCP meeting away from pure science and equations toward and more socio-economic and people-centric focus. Now DBCP was concentrating more on why the data was being collected and for what purpose. He applauded this and felt that this was in part due to the contribution of ASCLME. He wondered therefore does this unique group have a specific and unique role?

ND: Yes, there is clearly a need for the DBCP, let's just make sure that the efforts (venn diagrams) overlap.

DV: We are in a unique position to demonstrate how it should be done – for applications to drive the science. In this sense the DBCP can act as a pilot for science-to-governance development

YS: We should also think how we can assist the training institutions in the region. We need to review what is being taught and what is being added.

DV: We have a capacity building section in the MEDAs that should address that.
AM: Agree with Lucy and Nick that training links should be made with IODE, but training should be done in this region. Not clear on IO GOOS objectives if they include climate and weather objectives.

DV: Yes, we need to look beyond oceanography – to all components of the ecosystems including people.

2. Equipment needs

RS – Just to add to this overview slide – also to include survey requirements, not only equipment.

GP – There is a huge gap on the high seas, where there is huge biomass available, and we're starting to work up a picture of that, together with the CSIRO. Understanding that would have quite significant equipment requirements.

DV – encouraged comments from the countries

HR – Yes, in Madagascar we have decided to use this equipment in the NW and SW. Some fishing companies are willing to make vessels available, but the cost is significant. Smaller vessels pose risks. Working with prawn fishing companies can be an advantage. ASCLME cruises and ARGO provide good data for offshore, but now we need to concentrate on the inshore areas.

DV: ASCLME has been setting up several bilateral agreements. Perhaps in the interim, ASCLME should be setting up smaller agreements within country? Cooperative agreements as a preliminary to a wider alliance.

HR: We have discussed these issues with commercial companies. I agree, perhaps in Nosy Be we could set up an agreement with one company that is very interested in environmental monitoring, however, we'd be limited to the area of interest of the fishing boat. The navy is another potential partner, but not sure of the facilities available.

DV: ASCLME provided intensive training in Cape Town, wonders how many people are still using the training.

KG: Seychelles planned their survey for November, but had not yet received the equipment. As soon as the planning for the research vessel starts, she will submit her monitoring plan. Planned to do the surveys in the North as it is a gap in Argos.

AA: Comoros has done their training, but not yet received equipment (we will check with Helen). They have planned a stakeholder meeting to check which products are most useful to the end users. In Comoros, it would likely be for fisheries application. They need to know what kind of information could be most useful for fishermen. It is expensive to collect this kind of data, but there are other sources – internet etc.

DV: Would it be useful to arrange a workshop between fishermen and fisheries managers in Comoros?

AA: Yes it would, we have never had a meeting with the fishermen. There is some awareness raising of environmental issues in villages, but for the oceanographic monitoring, there needs to be some interaction with the users. People are asking why we are collecting the data, and for what purpose.
HR: With regard to the agreement with ships, we could have a similar agreement to the one SWIOFP has with vessels.

AA: Again, would be good to sensitize fishermen before engaging with projects.

GP: If we want to engage fishermen, it would be good to show them how environment affects fish distribution, they'd be a lot more interested in what you're doing.

DV: Yes, Comoros might be a good place to demonstrate such an exercise. ASCLME will look into this possibility of using Comoros as a pilot for fishermen/managers interactive meetings.

CM: Two scientists received pre-cruise training in Cape Town, and one technician was training in Mauritius for nearshore monitoring. Looks at capacity in 2 ways, short term and long term. Some scientists are doing masters/PhD, and that in itself is capacity building. DBCP is another example. We have received the nearshore monitoring equipment from the ASCLME. SWIOFP has been doing nearshore cruises, they'd like to have a joint cruise using SWIOFP vessel and ASCLME equipment. They would very much like to use gliders along selected transects along the Kenyan coast. Kenya has completed the MEDA process, and will now be working on the CCA and TDA, and they'd like to take these ideas forward at that time.

MH: We have benefited from training from ASCLME, and had observer training from SWIOFP, cruise programme was disturbed because of piracy. Their department does have a long term monitoring programme which is mainly concerned with coastal waters, water quality and coral reef monitoring etc. They contribute to NODC, and the ministry of environment.

AM: Not sure if nearshore equipment included bathymetric data, but that is needed by Kenya. The immediate problem is data storage.

LS: ASCLME and ODINAFRICA are doing a joint assessment of capacity for long term ocean and coastal data management, updated from an earlier study, in 2010. This is a complementary activity and should shed additional light on regional capacities and where to focus in future.
EA: The capacity building requirements are not too different from the other countries. Mozambique has received training from the ASCLME, like other countries, and we will be receiving equipment and will soon be in a place to commence data collection. Some scientists have been trained in Cape Town. Another thing we should address is access to open ocean vessels.

DV: Perhaps prior to DBCP 2012, we could circulate a questionnaire based on these 4 slides.

Tea

MR: Drifters are easy to deploy, cheap to acquire, and should be on the list as well. JCOMM has agreed to provide some drifters.

3. Data Access

LS: Gave a short overview of ASCLME data management structures. (Regional data management plan; together with countries have system for managing metadata and cruise data; ultimately all data will be available in public domain; data will be archived at NODC's in each country and data will be available in multiple regional data nodes; African Marine Atlas; literature also being compiled and will be on Oceandocs (IOC-UNESCO) – partner projects manage data differently but there are links from ASCLME site).

HR: Enquired about multibeam data from the Nansen.

GP: good idea to provide in gridded XYZ format.

YS: Many of us weren't aware of the data portals presented yesterday (by Lucy), so that is another important step in awareness.

AM: Two main communities. Operational and research based. ASCLME is mainly collecting delayed mode data (for research), what about near-real time data?

RS: Delayed mode does not necessarily mean non-operational.

AM: There is no strong coordination between the focal points of ASCLME at KMFRI and the met services.
DV: Yes, there is a requirement that the countries facilitate in-country cooperation between agencies in countries. If there anything that we can assist with, we will.

JK: Who is the data manager for Tanzania? Reply given.

4. Capacity Building for Data Analysis

HR: Their challenge is that people move and suggests that institutions be strengthened so that training can be continued.

DV: This is a very difficult challenge with no easy answers, solutions are welcome. How feasible is it to do training in countries as opposed to SA or overseas?
HR: It would be good to train trainers, as well as link with other institutions at Nosy Be and Tulear, so that someone can mentor new oceanographers.

DV: And we also need more than one skill set, and look beyond oceanography

GP: Going back to ecosystem analysis and fisheries assessments, the types of models that are being used these days are data hungry, and there will be training courses for training people on how to use them.

DV: Yes it will be important to develop centres of expertise.

AM: Will be good for us to get training in ocean-atmosphere coupled models.

AA: It would be important for us to have training for PhD scientists

YS: This should go along with the reviews of institutional courses and capacities. Perhaps there could be some guidance for new research and theories to be incorporated into curricula.

Tanzania Met: Not currently collecting marine data at met services, but it would be good for them to be involved.

JS: So we should spend some time focusing on marine meteorology? Agreed.

5. Delivery of End Products

ND: Agrees that this is critical, gets to the essence of why this training course was planned. Would be good for the country participants to articulate – what are the end products? This will allow us to keep focus on user needs at future workshops.
If there are gaps in the observing system as it is developing,

DV: Reviewed the science to governance process as well as the development of the Alliance.

MR: It's intimidating to provide information to inform policy – because the consequences are significant.
AM: If we really want to put this into the DBCP exercise, we might be overstepping protocol. DBCP is a project of JCOMM is a joint activity of IOC and WMO.

DV: No, just proposing DBCP advice on requirements for end products. The other points will be addressed by ASCLME [DV explained that not proposing that DBCP adopt a mechanism for taking science to policy briefs etc. This is one of the roles of ASCLME, to work with the countries to develop such a protocol]

<u>Planning for next meeting</u>
ND: With respect to the next meeting – can our colleagues here think about who are the right people from the countries from the right sector(s)? Agreed.

Recommendations for Sustained Observations in SWIO.
4. Agulhas System air-sea flux buoy
5. Long-term monitoring of Agulhas Current (transport and water masses)
6. Reference mooring in Mozambique Channel (LOCO)

Modelling experiments to understand Agulhas Leakage – Will
How water masses are transformed and leak into the South Atlantic?
Observations are important for global studies and questions and regional programs and questions.

Strong regional ties are important.
1~3 is the recommendation to international community.
Facilitate international communities interested in this region to come in.

Appendix 3 List of Participants

Title	First name	Last name	Country	Agency	Position	Email
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Dr.	Lisa	**Beal**	USA	Rosenstiel school of marine and atmos science SCOR	Associate Prof	lbeal@rsmas.miami.edu
Dr	Meghan	**Cronin**	USA	NOAA PMEL SCOR	Oceanographer	meghan.f.cronin@noaa.gov
Dr	David	**Vousden**	South Africa	UNDP ASCLME	Director	david.vousden.asclme.org
Dr	David	**Meldrum**	Scotland	Scottish Marine Institute SAMS	Research Fellow	dtm@sams.ac.uk
Dr	Michael	**Roberts**	South Africa	DEA Oceans and Coasts	Program leader: Op Ocean	squid@metroweb.co.za
Dr	Jean Francois	**Ternon**	France Reunion	IRD	Scientist	jean-francois.ternon@ird.fr
Prof	Wil	**de Ruijter**	Netherlands	Utrecht University	Professor	w.p.m.deruijter@uu.nl

Appendix 4 Regional Piracy Update

Introduction

Piracy is a global problem, but heavily concentrated in the northwestern Indian Ocean (Figure 11). Piracy in this Region is becoming more serious, and it is becoming impossible to arrange research cruises in the northwestern region of the Basin. Piracy is adversely impacting Indian Ocean climate research, observations, modelling and consequently the world's ability to address the impacts of climate variability and climate change.

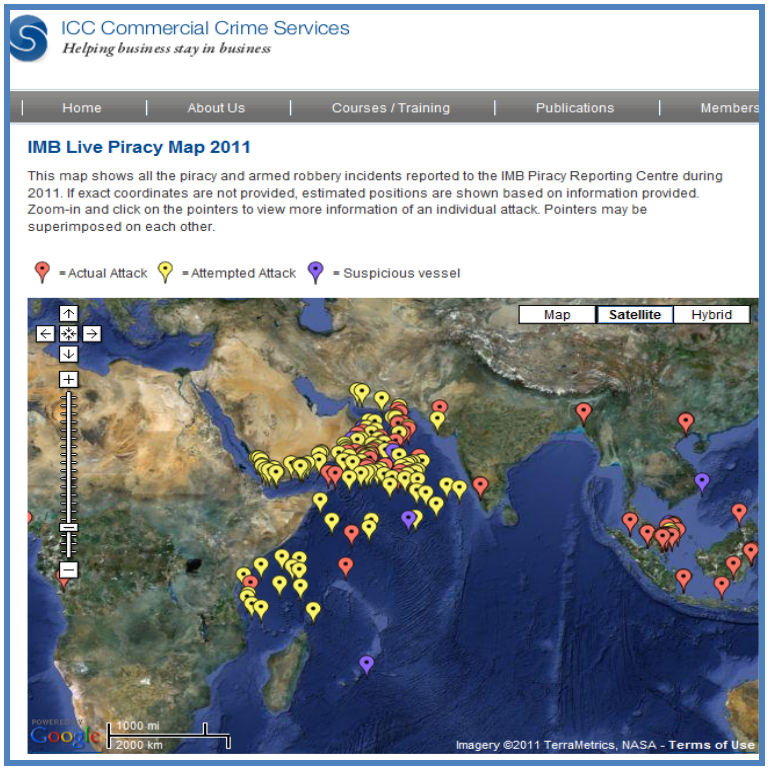

Figure 111 Indian Ocean Piracy Events in 2011

The Press has reported recently on the Indian Ocean Piracy problem and specifically how it is impacting Science in the Region, for example:

"Pirates Scupper Monsoon Research", **Nature**, 7 July, 2011
"Piracy is stopping oceanographers and meteorologists from collecting data vital to understanding the Indian monsoon…"

"Navy to Help Climate Scientists in Pirate-Infested Waters", **New York Times**, 14 July, 2011
About a quarter of the Indian Ocean is now off limits to climate scientists trying to complete a global network of deep ocean devices that gather data crucial to climate change studies and weather forecasts.

In response to numerous Piracy incidents in the Western Indian Ocean, *Lloyds of London* declared an Exclusion Zone (EZ, Figure 12) within which additional premiums are required to provide insurance to merchant vessels. In early 2011 the eastern border of the EZ was extended from 65°E to 78°E. Green symbols are surface RAMA moorings. **The EZ includes most implemented and planned RAMA sites along 55°E and 67°E.**

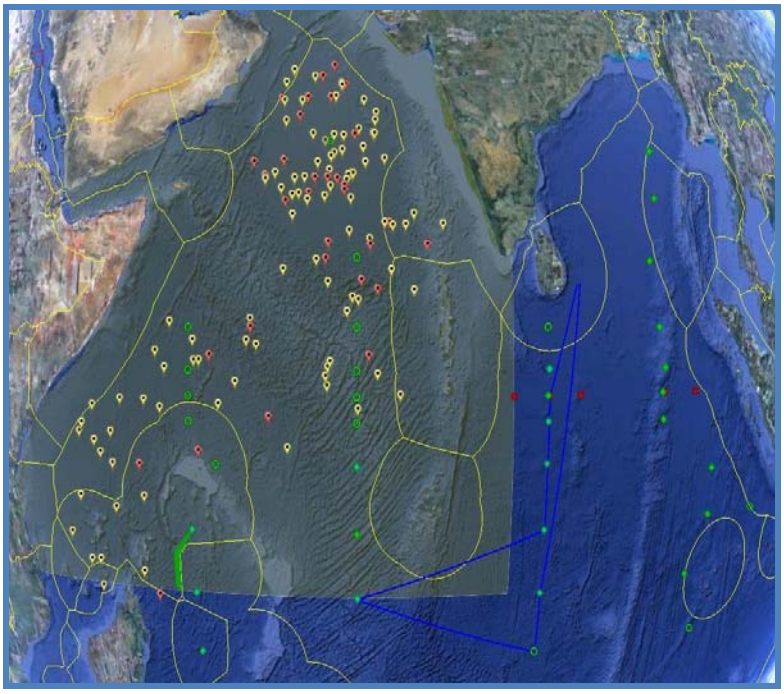

Figure 12 Updated Piracy Exclusion Zone
(Green Open Circles Are RAMA Sites To Be Implemented)

Over the past 6 years, 30 of 46 planned buoys have been installed; **13 of the 16 remaining RAMA Sites are in the EZ (open green circles).** Red dots are subsurface moorings. Red and yellow place marks show Pirate events for the period January 2010 through May 2011. Events along the coast of Africa and Arabia (far from mooring sites) have been omitted. Note the lack of piracy incidents in the SE portion of the EZ.

Appendix 5

Feedback and Recommendations for Improvement of Capacity Building activities Information gathered from participants of Model Development Team Capacity Building workshop

The effort put in by the SCOR working group and associate members was significant and this showed in their hands on lectures, all of which were very well attended. Unfortunately there was not time for all of the working group to give hands on tutorials (Arne Biastoch, Juliet Hermes, Pierrick Penven, Graham Quartly and Tomoki Tozuka, as well as Isabelle Ansorge on behalf of Johan Lutjeharms), although they were able to give some presentations (Lisa Beale, Arne Biastoch, Will de Ruijter, Tomoki Tozuka and Meghan Cronin). SCOR funded the attendance of the SCOR working group.

All members had open and enthusiastic discussions with the regional scientists and some good networks were created between the international and regional scientists. Everyone gained from the knowledge shared and there is a good deal of interest from the regional participants to remain informed of the SCOR working group activities as well as the activities of the members.

Feedback from Regional Scientists.

- *Members of SCOR were keen to share knowledge and new ideas as well as engage us in profiling and networking.*
- *This was probably my first ever most interactive and knowledge intensive (workshop). The lunches proved fruitful get-together sessions with specific persons of interest. The great interest by SCOR members to share knowledge and ideas with 'new' members was enviable.*
- *It is important to mention that the meeting with some scientists have contributed enough to my scientific work on the eddies in the Mozambique Channel, which is in its final phase*
- *This workshop provided me with the best platform to know about climate change related research and monitoring programmes that are ongoing in this part of the world. It was also very enriching to learn from experts from all around the globe about their research activities and publications in our region.*

In general, all of the regional scientists who gave feedback expressly thanked their funders and SCOR, as well as MOI, and the DBCP. All participants gave positive feedback about the interactions with the SCOR scientists, particularly over the lunch time interaction sessions and were enthused by the interest of SCOR members to share knowledge and ideas.
There was a general consensus that the skills and knowledge gained will be applied at the home institutions and that all of the materials shared will be a good starting point. Also, that the networks which began being established will assist in issues arising in different thematic regions. There was a general consensus that, where possible, the regional scientists would like to keep contact with the SCOR working group and receive any relevant information from them.

It was also clear that the regional scientists would like their contributions to be incorporated into any of the ongoing projects, where possible, in particular, there is much inshore work being done in the region and it would be of interest to link this with the offshore work.

A major issue coming from all the feedback was the hotel selection; it was considered relatively expensive compared to per diems and although in an idyllic beachside locality (offering beautiful extra-curricular coastal and marine options) it was at the same time relatively isolated in respect to proximity to general facilities and services. Although highly desirable to keep everyone together, it was logistically difficult to eat out (no public transport and relatively expensive taxi costs). As is common in resort style hotels, the cost of food and day to day requirements were significantly above general diem budgets for delegates, particularly those coming from developing countries. The other issue was that there was not enough time for hands on training.
Below is some specific feedback from the sponsored regional scientists.

- The workshop mainly revolved around existing and ‘new’ scientific advances in the region. To understand the varying dynamics of our ocean, relevant and critically important knowledge and skills are required. There was special focus on existing and emerging technology advance in ocean observations and data analysis in the region,
- It was important to have observation and modeling development teams as part of a wider strategy in building and advancing the capacity to locally, regionally and globally observe and model our oceans,

- Creating and maintaining wide functional scientific networks within the Western Indian Ocean will improve the level of participation by various groups of scientists and managers and this is greatly important for conservation of biodiversity important and vulnerable/ susceptible regions in the Western Indian Ocean,
- There were deliberate efforts to equip the participants with relevant knowledge to better understand the varying dynamics of Indian Ocean, the Agulhas current and how it affects the climate in the region,
- Several lectures, software, and reference materials were made available to assist in building the much-needed capacity in order to address issues that arise in different thematic fields,
- The scientific presentations were updated topics and of a wide range of interest. The trainers shared their skills well,
- There was a good representation of the countries adjacent to the Indian Ocean.

Future Workshop Recommendations

DBCP organizing committee should ensure that a requirements list be provided to the next host ensuring that all logistical matters such as venue, transport and accommodation is resolved prior to the annual DBCP meeting held in September. It would also be good for a member of the committee to visit the proposed venue.

It is strongly recommended that the CB task team do away with break-away sessions and only have plenary sessions.

One of the more common trials, experienced by all participation countries was the shortage of funds for marine observations networks. There were examples provided by some as to how these can be overcome by partnerships, and tapping into the already existent observations networks, that have solid and established frameworks.

More practical sessions be introduced for the observations as well as modelers, therefore it is advised that all formalities be concluded on the first day prior to afternoon tea ensuring sufficient time for capacity building.

Start and finish time should be looked at especially if the sun rises early allowing participants more time to relax after a very long day.
Another point that came to the fore was the problem of piracy, which threatened not only the sciences in the region, but the regular sea traffic as well. It became apparent that the pirates are becoming more brazen in the attacks, and that their activities have spread well south of the Somali coast as at the beginning, and now stretch to just south of the Seychelles.

The fact that modeling and observations were not combined there was a gap in the sense that "observation team" was not able to get a better understanding of the requirements of the "modelers" and the "modelers", in turn, could not articulate their requirements to the "observation team". Therefore break away sessions should be avoided.

In studying the importance of the Greater Agulhas Current, it may be good to also consider the region beyond the Mozambique Channel and also cover the East Africa Coastal Current as well as the Somali Current. While we acknowledge that security is an issue due to the piracy threat, we could carry observations by means of ocean gliders till the situation improves to explore the area on board research vessels.

The software/programs being used in the modelling is technical, requiring time to learn and exercise these skills which were difficult to master in the limited time! – If the same participants come each year (as planned) this will help. Also if the whole week is dedicated to capacity building this will also help. The trainees have many limitations in using research platforms, such as Linux operative system, and limited scientific software. The trainers found very difficult to deal with such a problem. Time should be invested in well-equipping regionally balanced participants with necessary basics which will then be exercised in later sessions within the same workshop

There was an expectation that we would learn about running models. However it is now apparent that it is important to know the software and operating systems etc in advance and this was useful to learn. It was also great to meet people, especially as the trainers were so willing to carry on the support after the workshop.

There was a focus on physical oceanography with no connection to systems dependent on these physical parameters, such as biodiversity. As much as we understand the physical ocean, equal effort should also be directed to understanding the biodiversity dynamics too. Thus the importance of having ecological modelling teams should be considered. The ecological teams will rely a lot on biological scientists to provide biological data for customized models and this will be a value added collaboration which can potentially assist in policy formulations that address management and conservation of biodiversity.

Though the trainees learned where to find the data, it seemed obvious that they do not know how to use it.

Specific Comments and Recommendations from MDT Lead Dr. Juliet Hermes SAEON:

(1) More prior information needs to be exchanged between the organizers and the trainees well in advance of the workshop so that materials and tools are designed and chosen appropriately. In particular:

- **Do the same trainees participate each year**? What is the selection process? What is their skill level (collect their C.V.s and a list of what tools they use, e.g. linux, opendap, netcdf)? What do trainees want to achieve? Do they want operational or academic training?
- **Compatibility of operating systems and software is probably the biggest issue hindering effective capacity building.** Informed decisions need to be made early to standardize tools and provide them to both organizers and participants. Workshops should be taught using the computing tools available and/or familiar to participants - e.g. most do not have access to expensive software like matlab, even though this is the tool perhaps most familiar to organizers. A computer/software technician is needed to help organizers transition their scripts and databases into standardized tools (e.g. freeware alternatives). This is imperative.
- **Trainees should have the support/time/tools to work on their new skills when they return to their institutions** (how can organizers promote institutional buy-in)?
- **The date, venue, organizers, and trainees should be finalized at least 2 months prior** to the workshop so that the appropriate information can be exchanged (e.g. a comprehensive list of email addresses, basic information about trainees skills and needs etc), effective workshops designed, and glitches (e.g. software compatibilities) worked out.
- Expectations shouldn’t be too high (i.e. trainees won’t be able to learn how to run a model with data assimilation in a 2-hour session)

(2) **More time should be given to capacity building at the meeting** and less time to talks and introductions.

– At the DBCP workshop capacity building took up only 50% of the time and did not begin until Wednesday. Lectures in the morning with afternoon workshops beginning day 1 would be better. Some introductions could be done during lunch or dinner.

– 5-minute science 'pop ups' by trainees were popular (although difficult to get out of people) and an essential brief introduction for everyone. The first day should be devoted to this type of brief science introduction and discussion (for organizers as well).

– A room should be available for trainee assignments in the evening and to encourage interaction and resource sharing between trainees.

– More social events

(3) Workshops need to be more focused, with **instructions for trainees provided in advance of the workshop, evening assignments given, and follow-up after the workshop**.

– Post user manuals and/or workshop notes on the meeting website. A list of acronyms. A 'cookbook' of information and where you can get information from. A list of tools needed (computer, software etc).

– Provide deliverables - **set reports and assignments for trainees to complete during the week, perhaps in teams, with an award for the best assignment.** Provide a certificate of attendance that they can show to their institute directors.

• Encourage and support trainees to do follow-up assignments at their home institution, paired with an organizer for guidance and advice. Match up trainees with international mentors. Have trainees present their work at the next workshop.

• Focus on fewer topics, but in more depth. Combine observations and models for at least one session. Take ideas for topics from trainees - e.g. interest in ecology, biodiversity, and coastal wave modeling.

• **Put together a program to turn gifted trainees into trainers** - e.g. one trainee this year will put together a how-to on OPENDAP and then work with Brassington (Bluelink) to give a workshop at next year's meeting. Provide a forum for discussion and questions on the meeting website (wiki?) to facilitate continued learning.

• Offer a DBCP student/trainee stipend for experience at a NOAA lab or research at UCT or internationally. Send trainers to regional institutions and universities to teach for a week/month/semester.

(5) Venue

• A meeting venue located (in town) where there is a **choice of accommodation and restaurants is recommended so that self-funded trainees can afford to attend** and trainees can find reasonably priced meals. A resort is too expensive and remote.

Appendix 6 List of Individual Action Items

Name	Action	Status
Numerous	Workshop Resolutions 1-5	Ongoing
David Meldrum	Investigate (with AMESD) the possibility to use the widespread Eumetcast service for the distribution of archived datasets as well as products in support of regional modelling efforts, particularly in those areas where Internet connectivity is poor	Ongoing
David Meldrum, Ali Mafimbo, Bill Burnett	Pursue the establishment and funding of a glider pilot project with the Kenyan Meteorological Department, to include local training in glider use and a demonstration mission, with the ultimate aim of establishing a sustained programme with UNDP support	Ongoing
David Meldrum	Investigate the existence of retired communications cables between Madagascar and the mainland for possible monitoring of bulk transport through the Mozambique Channel	Ongoing
David Meldrum	Pursue ASCLME offer of shiptime for drifter/float deployments	Ongoing
Sidney Thurston	Provide an Update on Western Indian Ocean Piracy Activities and their Impediments to IndOOS/RAMA Implementation	Completed (App 4)
David Meldrum	Coordinate a list of potential regional participants in drifter programmes for onwards transmission to SAWS, who hold a substantial stock of SVP-B drifters	Ongoing
Sidney Thurston, Ali Mafimbo, Charles Magori	Coordinate Preparations for WIO-3 in Mombasa Kenya to Present to DBCP Executive Board and TT-CB at DBCP XXVII in Geneva	Ongoing

Appendix 7 UNDP-NOAA Memorandum of Agreement

Memorandum of Agreement

Between

United Nations Development Programme (UNDP)

And

National Oceanic and Atmospheric Administration,
Department of Commerce,
Government of the United States of America (NOAA)

For

Technical Support, Research Cooperation,
Technology Deployment and Data Management in Respect of the
Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction
(RAMA) Network

WHEREAS the Governments of Comoros, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, Somalia, South Africa and Tanzania (hereinafter the "Participating Governments"), on the one hand, and the United Nations Development Programme (hereinafter "UNDP"), on the other hand, concluded a project document for the Agulhas and Somali Current Large Marine Ecosystems Project (hereinafter the "UNDP ASCLME Project Document" or the "UNDP ASCLME Project"),

WHEREAS the UNDP ASCLME Project Document recognizes the need for the deployment of long-term equipment for the purposes of monitoring climate change, ecosystem variability and building early warning systems, and calls for technical cooperation in the implementation of the UNDP ASCLME Project through the Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (hereinafter "RAMA") network, which includes the autonomous temperature line acquisition system (hereinafter "ATLAS") moorings of the National Oceanic and Atmospheric Administration, Department of Commerce, Government of the United States of America (hereinafter "NOAA"),

WHEREAS, pursuant to the UNDP ASCLME Project Document, NOAA serves as a technical agency with an observer status on the UNDP ASCLME Project Steering Committee,

WHEREAS Annex 13 to the UNDP ASCLME Project Document, entitled "A Comprehensive Partnership Between NOAA and ASLCME," sets out the basic principles and fundamental aspects of technical cooperation between NOAA and UNDP in joint research, technology deployment and data management,

WHEREAS UNDP recognizes NOAA's role as an important partner and stakeholder in the UNDP ASCLME Project and NOAA is willing to cooperate with UNDP in the development and

implementation of the RAMA network, as contemplated in the UNDP ASCLME Project Document, subject to this Memorandum of Agreement (hereinafter the "Agreement"),

WHEREAS, as contemplated by Annex 13 of the UNDP ASCLME Project Document, NOAA has informed UNDP of its willingness to contribute support towards the development and implementation of the RAMA network through an in-kind contribution of equipment and technical services (hereinafter the "Contribution"),

WHEREAS, pursuant to the UNDP ASCLME Project Document, the United Nations Office for Projects Services (hereinafter "UNOPS") serves as an executing agency of the UNDP ASCLME Project,

WHEREAS in its capacity as an executing agency, UNOPS is responsible for issuing contracts and entering into agreements for the hire and use of research vessels, where such vessels are needed for the purposes of implementing activities under the UNDP ASCLME Project,

WHEREAS NOAA shall have the use of the aforementioned research vessels and the equipment located thereon to the extent provided for under the aforementioned UNOPS contracts/agreements and the terms of this Agreement;

NOW, THEREFORE, UNDP and NOAA (hereinafter the "Parties" or, individually, a "Party") agree as follows:

Article I
NOAA's Contribution and UNDP's Activities

I. NOAA represents that it has authority to contribute to the RAMA network under:

(a) 15 U.S.C. section 1525, the Department of Commerce's Joint Project Authority, which provides that the Department may enter into joint projects with nonprofit, research, or public organizations on matters of mutual interest, the cost of which is equitably apportioned;

(b) 15 U.S.C. section 313 which provides NOAA authority for the forecasting of weather, the issue of storm warnings, the display of weather and flood signals; and

(c) 15 U.S.C. section 2904 et seq. which provides general authority to NOAA for the conduct of a National Climate Program.

2. NOAA's Contribution is necessary and essential to further the mission of the Department of Commerce, Government of the United States of America, in that it will advance environmental stewardship and climate services and strengthen NOAA science. NOAA has determined that its work towards the development and implementation of the RAMA network cannot be

carried out at all, or carried out as effectively, without the UNDP ASCLME Project because NOAA ships do not routinely operate in the Indian Ocean and ship time is essential to the success of the RAMA network. The technical cooperation in research, technology deployment and data management contemplated under this Agreement is of mutual benefit to the Parties because they are interested in improved science based management of the marine resources and improved climate assessments and forecasts.

3. NOAA shall contribute to the development and implementation of the RAMA network, free of charge, the following:

(a) All RAMA or other long-term monitoring related mooring instrumentation and hardware for the deployment of NOAA subsurface Acoustic Doppler Current Profiler and surface ATLAS moorings;

(b) Training of UNDP personnel involved in the development and implementation of the RAMA network, pursuant to the UNDP ASCLME Project Document, in mooring deployment and recovery onboard the research vessels when and if such vessels become available to UNDP pursuant to the contracts/agreements referred to in the preamble;

(c) One week training session per year for up to two (2) UNDP technicians/scientists at the Pacific Marine Environmental Laboratory (hereinafter "PMEL") (Seattle, Washington, USA) on the preparation of instrumentation and mooring hardware, data processing and quality control;

(d) Moorings as potential platforms for ASCLME instrumentation, provided these instruments do not interfere with primary RAMA measurements or mooring survivability;

(e) Representation to attend the UNDP ASCLME Project technical and policy level meetings in fulfillment of NOAA's role as an observer on the UNDP ASCLME Project Steering Committee;

(f) A portable winch and inflatable boat for mooring operations if not readily available on the research vessels referred to in paragraph (b) above;

(g) Costs of shipping equipment to and from the pm1s of call to be determined by UNDP;

(h) The processing of data received from the moorings by PMEL into engineering units such as temperature, velocity, and salinity units, as well as quality control of said data to make sure it is within the bounds of scientific parameters;

(i) The display and dissemination of data telemetered in real-time from surface moorings on a public web site, to be agreed between the Parties. These data will be made available to UNDP, the Participating Governments and other interested research partners;

(j) Dissemination of delayed-mode data to the Participating Governments and other interested research partners within six (6) months of mooring recovery;

(k) Salaries and expenses for two (2) NOAA technicians who will participate in activities to support the UNDP ASLCME Project; and

(I) Travel expenses for NOAA technicians to and from the ports of call to be determined by UNDP.

4. In making the Contribution, NOAA shall be responsible for:

(a) Customs clearance, at no cost to UNDP, of its equipment shipped to customs points of entry for the fulfillment of its responsibilities under this Agreement; and

(b) Provision of all necessary arrangements to facilitate entry to and exit from its country of personnel and equipment to any of the countries engaged in the UNDP ASCLME Project.

5. UNDP and NOAA recognize that in order to provide the Contribution, NOAA will require ship time aboard research vessels hired for the UNDP ASCLME Project activities in order to deploy and maintain the moorings. In this connection, the research vessels need to have:

(a) A continually operable capstan or winch with controllable speeds (desirable speeds -40m/min), with fully functioning crane capable of safely lifting 3000kg at sea;

(b) Tic-down points to secure mooring equipment while underway and for tag lines during deployment;

(c) Deck lights for night operations;

(d) Bathymetric equipment capable of producing bottom surveys at full ocean depth (6000m);

(c) Room and board for up to three (3) NOAA technicians during each cruise (paid for in full by NOAA);

(f) Ship personnel for technical and deck support during mooring operations;

(g) High quality meteorological (wind speed and direction, air temperature, relative humidity, rainfall, short and long wave radiation, and barometric pressure) and oceanographic (conductivity, temperature and depth to 1OOOm) measurements from the research vessel when near the mooring sites; and

(h) Opportunities for deployment of drifting buoys and profiling floats along scheduled cruise tracks as long as such deployments do not interfere with the conduct of the UNDP ASCLME Project or RAMA field work.

6. It is anticipated by the Parties that under this Agreement, up to forty (40) dedicated Days at Sea (hereinafter "DAS") will be needed each year on research vessels for the deployment of the NOAA ATLAS climate moorings along 55° East Longitude.

7. These DAS, intended to commence in the second half of 2011, would be dedicated to servicing NOAA climate moorings located at the Indian Ocean observing system/RAMA sites along 55° East Longitude as well as conducting bathymetric surveys by the Parties required for their deployments.

8. The Parties recognize that due to instrumentation and battery longevity constraints, the length of time between successive servicing cruises is recommended at a minimum of nine (9) months and a maximum of fifteen (15) months. The Parties further recognize that the DAS may be separated into two (2) or more cruises distributed throughout each service period and begin/end at ports identified by the Parties at least ten (10) weeks in advance of the cruises.

9. The Parties' respective scientists shall meet yearly to plan upcoming cruises and discuss research initiatives and application of data.

10. UNDP shall also be responsible for-

    (a) Customs clearance, at no cost to NOAA, of its equipment shipped to customs points of entry for the fulfillment of its responsibilities under this Agreement; and

    (b) Provision of all necessary arrangements to facilitate entry and exit of its personnel and equipment to and from any of the countries engaged in the UNDP ASCLME Project.

Article II
Utilization of NOAA's Contribution and Implementation of UNDP's Activities

I. The implementation of the responsibilities of the Parties pursuant to this Agreement and the UNDP ASCLME Project Document shall be dependent on the Parties' ability to provide their respective support for the RAMA network. If unforeseen additional needs of either NOAA or UNDP are expected or realized that are of the same type or nature as the support contemplated hereunder, either Party will submit to the other on a timely basis a supplementary estimate showing the further contributions that will be necessary. Each Party shall use its best endeavors to provide such required support.

2. If the support is not provided, or if additional and related support required is not forthcoming from either Party, or other sources, the assistance to be provided by the other Party to the development and implementation of the RAMA network under this Agreement and the UNDP ASCLME Project Document may be reduced, suspended or terminated.

Article III
Areas of Cooperation and Coordination of Activities

1. The Parties recognize that there are security concerns such as piracy within the area of intended operations under this Agreement. Accordingly, (i) the responsibility for the safety and security of either Party rests only with that Party; (ii) neither Party shall be held responsible for any delay or inability to meet its commitments under this Agreement, or for incidents caused by the security risks within such area; and (iii) each Party shall assume all risks and liabilities related to the safety and security of its own personnel and equipment.

2. The Parties agree that there shall be no exchange of funds between the Parties.

3. Each Party shall provide staff, facilities, and other support necessary for implementation of the activities under this Agreement as mutually determined by the Parties. Such support shall be subject to the availability of appropriate funds and personnel, and shall be in accordance with the Panics' respective regulations, rules, policies and procedures.

4. The officials, representatives, employees or subcontractors of either Party shall not be considered in any respect as being the employees or agents of the other Party.

5. The cooperation between the Panics under this Agreement shall be on a non-exclusive basis.

6. The Parties shall coordinate and engage with other organizational entities as appropriate and necessary in undertaking the activities under this Agreement, subject to the Parties' respective regulations, rules, policies and procedures, and within their respective mandates.

7. Consistent with the UNDP ASCLME Project Document, the expected results of the cooperation between the Parties are as follows:

   (a) Support by NOAA, by the end of the term of this Agreement, of nine (9) of the forty-six (46) moorings in RAMA;

   (b) Promotion of the development of the Indian Ocean observing system, the UNDP ASCLME Project and other large marine ecosystems (e.g. Bay of Bengal large marine ecosystem) with other potential international partners;

   (c) Promotion of the use of the data generated for improved weather, ocean, ecosystem, and climate forecasting, with special emphasis on prediction of African rainfall and Climate Variability Indicators on Regional Ecosystems, by the Participating Governments and the world community at large;

   (d) Shared results of data analysis and published papers in the peer-reviewed (refereed) literature, consistent with the Parties' respective regulations, rules, policies and procedures.

8. The overall coordination of the activities set forth in this Agreement shall be carried out by the Technical Specialist, UNDP Global Environment Facility, and the Director of NOAA's RAMA Program, whose contacts details are as follows:

For UNDP:
Akiko Yamamoto
Technical Specialist
UNDP Global Environment Facility
ASCLME House
Private Bag 1015, Somerset Street
Grahamstown 6140
South Africa
Tel: +27 12 354-8125

For NOAA:
Dr. Michael McPhaden
RAMA Principal Scientist
Pacific Marine Environmental Laboratory
NOAA, Department of Commerce, Government of the United States
7600 Sand Point Way NE
Seattle, WA 98115
USA
Tel +1 206 526-6239

Their respective responsibilities shall include:

(a) Management and coordination of activities undertaken under the auspices of this Agreement;

(b) Designation of appropriate personnel within their respective organizations to manage and coordinate activities under this Agreement; and

(c) Handling of all necessary arrangements to facilitate entry to and exit of their respective personnel and equipment engaged in or used in the activities under this Agreement.

Article IV
Administration and Reporting

1. The UNDP ASCLME Project activities, management and expenditures shall be governed by the regulations, rules, policies and procedures of UNDP and, where applicable, the regulations, rules, policies and procedures of UNOPS.

2. UNDP headquarters and the UNDP Country Office in Mauritius shall provide to NOAA all or parts of the following reports prepared in accordance with UNDP reporting procedures:

(a) From the UNDP Country Office in Mauritius (or the relevant unit at UNDP's headquarters, as appropriate), every year, the status of the UNDP ASCLME Project for the duration of this Agreement, as well as the latest available approved budget.

(b) From the UNDP Country Office in Mauritius (or the relevant unit at UNDP's headquarters, as appropriate) within six (6) months after the date of completion or termination of this Agreement, a final report summarizing the UNDP ASCLME

Project activities and impact of such activities, including usage of, or outputs achieved with help of, the Contribution.

Article V
Warranties and Representations

The Parties will confer at appropriate junctures to ensure that each Party's activities under this Agreement are acceptable to the other. If problems or deficiencies arc noted by either Party, they will be discussed at the earliest opportunity and steps will be taken to resolve them. This may include using the dispute resolution provisions set forth in Article XVI of this Agreement. If the issue cannot be resolved in this manner, the Parties may consider amending this Agreement, reducing the scope of each Party's commitment under this Agreement, or terminating this Agreement pursuant to Article XVII hereof.

Article VI
Limitation of Liability

1. UNDP shall not, except for acts of gross negligence or willful misconduct on the part of UNDP, be liable for any loss, damage, liability or expense incurred or suffered which is claimed to resulting from the activities set out under this Agreement, including without limitation, any fault, error, omission, interruption or delay with respect thereto. Under no circumstances shall UNDP or its employees, officers, agents or contractors be liable for any direct, indirect, incidental, special or consequential damages, even if UNDP has been advised of the possibility of such damages. NOAA specifically acknowledges and agrees that UNDP is not liable for any conduct of NOAA.

2. NOAA agrees to promptly consider and adjudicate any and all claims which may arise out of this Agreement resulting from the actions of the Government of the United States, duly authorized representatives, or contractors of the Government of the United States, and to pay for any damage or injury as may be required by Federal law of the United States, subject to the privileges and immunities of UNDP. Such adjudication will be pursued under the Federal Tort Claims Act, 28 U.S.C. Section 2671 et the Federal Employees Compensation Act, 5 U.S.C. Section 8101 ct or such other legal authority as may be pertinent.

Article VII
Encumbrances and Liens

NOAA shall not cause or permit any lien, attachment or other encumbrance by any person to be placed on file or to remain on file in any public office or on file with UNDP against any moneys due or to become due for any work done or materials furnished as part of, or in connection with the Contribution, or by reason of any other claim or demand against NOAA.

Article VIII
Insurance

NOAA is self-insured and no insurance will be purchased by NOAA for the purposes of undertaking activities under this Agreement. All claims resulting or arising from acts or omissions of NOAA will be processed by NOAA under the United States Federal Tort Claims Act, referred to in Article VI (2) above, and any other pertinent legal authority, subject to the privileges and immunities of UNDP.

Article IX
Copyrights, Patents and other Property Rights

The Parties do not anticipate that any patents or trademarks will be developed from the activities to be conducted under this Agreement. To the extent that any copyrightable work is produced, UNDP shall be entitled to all intellectual property and other proprietary rights to it, including but not limited to patents, copyrights, and trademarks. UNDP will permit NOAA to enjoy an unlimited and non-exclusive royalty-free license to disseminate any data created as a result of efforts conducted under this Agreement. NOAA intends to disseminate such data in real-time mode and in delayed-mode formats, as applicable.

Article X
Ownership of Equipment

Ownership of any non-consumable equipment, supplies and other properties that are formally donated by NOAA to the UNDP ASCLME Project shall vest in UNDP. Ownership of all other non-consumable equipment, supplies and other properties made available by NOAA for the RAMA network pursuant to the UNDP ASCLME Project Document shall remain the propet1y of NOAA. Matters relating to the transfer of ownership by UNDP shall be determined in accordance with the relevant regulations, rules, policies and procedures of UNDP and NOAA.

Article XI
Audit

The Parties agree to furnish each other, to the extent permitted under their respective regulations, rules, policies and procedures, such information or documents as may be needed to ensure accountability for funds and property required to satisfy each Party's commitments under this Agreement. Should a biennial audit report of the Board of Auditors of UNDP to its governing body contain observations relevant to the Contribution, such information may be made available to NOAA. In addition, should a report of the NOAA Auditors contain observations relevant to the Contribution, such information may be made available to UNDP.

Article XII

Privileges and Immunities

Nothing in this Agreement shall be deemed a waiver, express or implied, of any of the privileges and immunities of the United Nations, including UNDP, or of the Government of the United States of America.

Article XIII
Use of the Name, Emblem or Official Seal

A Party shall not, in any manner whatsoever, use the name (including abbreviations), emblem or official seal of the other Party in connection with its activities without prior written consent of such other Party. Under no circumstances shall such consent be provided in connection with the use of the name (including abbreviations), emblem or official seal of either Party for commercial purposes.

Article XIV
Officials not to Benefit

NOAA warrants that no official of UNDP has received or will be offered by NOAA any direct or indirect benefit arising from the Contribution under this Agreement.

Article XV
Observance of Law

NOAA shall comply with all laws, ordinances, rules, and regulations bearing upon the performance of its obligations under this Agreement.

Article XVI
Settlement of Disputes

Should disagreement arise on the interpretation of the provisions of this Agreement, or amendments and/or revisions thereto, that cannot be resolved at the operating level, the area(s) of disagreement shall be stated in writing by each Party and presented to the other Party for consideration. **If** no agreement on interpretation is reached within thirty (30) days, the Parties shall forward the written presentation of the disagreement to the respective higher officials for appropriate resolution.

Article XVII
Entry into Force, Amendment, Suspension and Termination of the Agreement

1. This Agreement shall enter into force upon signature by duly authorized representatives of the Parties.
2. This Agreement shall terminate five (5) years following its entry into force, but may be amended or extended at any time by mutual written consent of the Parties.

3. The Parties shall review this Agreement at least once a year to determine whether it should be amended, renewed, or canceled.

4. Either Party may terminate this Agreement by providing ninety (90) days written notice to the other Party. In the event this Agreement is terminated, each Party shall be solely responsible for the payment of any expenses it has incurred.

5. This Agreement is not intended to, and does not, create any binding obligations under international law.

IN WITNESS WHEREOF, the undersigned, being duly authorized thereto, have signed the present Agreement in the English language in two originals.

FOR THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE, GOVERNMENT OF THE UNITED STATES OF AMERICA

FOR THE UNITED NATIONS DEVELOPMENT PROGRAMME

Dr. Larry Robinson
Assistant Secretary for Conservation & Management
NOAA

DATE: 3 May 2011

Leyla Tegmo-Reddy
UNDP Resident Representative
Mauritius

DATE: 3 May2011

Appendix 8 Final Workshop Agenda

Day 1: Monday 2 May 2011
Opening Day Remarks, Regional Ocean Science and Technology Symposium

TIME	SUBJECT	LEAD
8:30-9:00	Registration	MOI
9:00-9:30 All Day, Plenary Room (*Bois de Rose*)	Welcome, Greetings and Opening Remarks Rezah Badal – Officer-in-Charge, Mauritius Oceanography Institute David Meldrum – Recent Chair, Data Buoy Cooperation Panel DBCP Johan Stander, WMO Representative Nick D'Adamo – Head, IOC-Perth Regional Programme Office Lisa Beal – Chair, Scientific Committee on Oceanic Research, 136 Troy Fitrell – Deputy Chief Of Mission , USA Embassy, Mauritius	Sidney Thurston (DBCP Capacity Building Task Team)
9:30-10:00	Host Keynote Address: Regional Perspective: MOI's Activities and Incoming Operational Services Using Earth Observations for Marine Applications	Rezah Badal (MOI)
10:00-10:30	Regional Environmental Science and Technology Symposium Opening Address: Social & Economic Relevance of Regional Ocean S&T: GEF/UNDP Agulhas Somali Current Large Marine Ecosystem Program ASCLME	David Vousden (ASCLME)
10:30-11:00	Morning Tea Break and Group Photograph	All Participants
11:00-1:00 Plenary Room	Symposium: The State of Western Indian Ocean Environmental Science and Technology	Nick D'Adamo Chair
11:00-11:30	1. Research: The Agulhas System and its Role in Ocean Circulation and Climate	Lisa Beal (RSMAS), Wil de Ruijter (Netherlands IMAU), Rainer Zahn (U. Barcelona)
11:30-12:00	2. Modeling: An Overview of Ocean and Coupled Models	Tomoki Tozuka (University of Tokyo), Arne Biastoch (IFM – GEOMAR), Pierrick Penven (IRD)
12:00-12:30	3. Observations: Overview of Regional Marine Observing Systems; including Indian Ocean Observing System, RAMA, XBT, ARGO, Drifters	M. Ravichandran (India INCOIS)
12:30-2:00	Buffet Lunch	
2:00-3:30	Symposium (continued)	Nick D'Adamo
2:00-2:25	4. Ocean Forecasting: From Ocean Observation to Applications: Update on IOGOOS Pilot Project – Modelling for Ocean Forecasting and Process Studies	Nick D'Adamo (IOC)
2:25-2:50	5. Strategic Approach: Benefits of Integrating Offshore and Nearshore Long-Term Ocean Observations For Sustainable National Fisheries	Rebecca Shuford (NOAA NMFS)
2:50-3:10	6. Capacity Building: WMO Integrated Global Observing System WIGOS: Highlights of WIGOS, Connection to DBCP and How This Workshop Contributes	Etienne Charpentier (WMO- telephone)
3:10-3:30	7. Next Generation: Developing Global Citizens and Connecting the Next Generation of International Scientists	Mark Brettenny (GLOBE)
3:30-4:00	Afternoon Tea Break	
4:00- 5:00	Discussion: Nearshore-Offshore Ocean Observing and Community Level Applications – Launch Applications Development Team (ADT)	David Vousden, Chair

4:00-4:20	Social-Economic Relevance: Benefits of Coastal (Nearshore) and Ocean (Offshore) Ocean Observing and Monitoring	Mardayven Nallee (Ecosystem Approach to Fisheries EAF –Nansen)
4:20-4:40	ASCLME Observing and Monitoring Efforts - Offshore - Nearshore Building the Nearshore-Offshore Connection	Lucy Scott; Regional Cruise Coordinators
4:40-5:00	French Contribution to the Observation of Oceanic Processes in the Indian Ocean and Their Imprint on Ecosystems	Jean Francois Ternon (IRD)
5:00-5:10	Daily Wrap-up & Tomorrow's Plans	Sidney Thurston (DBCP)

AGENDA
Day 2: Tuesday 3 May 2011
Remote & In-Situ Ocean Observation Resources Currently Available For The Region

TIME	SUBJECT	LEAD
9:00-9:10 *Bois de Rose*	Daily Planning, **AMESD Morning Symposium**	Sidney Thurston (DBCP)
9:10-9:30	Overview of the African Monitoring of the Environment for Sustainable Development Program AMESD	Francois Carnus (AMESD)
9:30-10:15	AMESD Activities, Products & Services In the South West Indian Ocean	Eric Martial (AMESD)
10:15-10:30	AMESD Q&A	David Meldrum (UK SAMS)
10:30-11:00	Morning Tea Break	
11:00-11:30	EumetCast & AMESD Data and Tools	Vimal Ramchandur (MOI)
11:30-12:00	First Step Towards Operational Forecasting on the EEZ of Mauritius Using ROMS Model	H. Runghen (MOI)
12:00-12:20	Oceanographic Atlas of the South West Indian Ocean Using Model Reanalysis	Arshad Rawat (MOI)
12:20-12:40	AMESD Pilot Project in Mozambique: The Use Of Potential Fishing Zone Maps for Fisheries Management	Emidio Andre (Mozambique, INIP)
12:40-1:00	Potential Synergies Between AMESD & In-Situ Regional Ocean Observations, e.g., in-situ cal/val	David Meldrum (UK SAMS)
1:00-2:30	**Buffet Lunch** Special Address: *NOAA's Engagement in the Indian Ocean Region*, Agreements Signing Ceremony	Dr. Larry Robinson, Assistant Secretary for Conservation & Management Leyla Tegmo-Reddy (UNDP)
2:30 – 2:50	Data Requirements for the Development of Coastal and Marine Atlas	Muhamudally Beebeejaun (Mauritius Met Service)

2:50-3:10	The Agulhas Return Current Ocean Climate Station: Using Drifting and Moored Buoy Data from the Agulhas System	Meghan Cronin (NOAA PMEL)
3:10-3:30	Regional Institute Operational Data Stream Requirements for Meteorological, Ocean and Climate Models	Ali Mafimbo (Kenya Met Dept)
3:30-4:00	Afternoon Tea Break	
4:00 – 4:25	Predictions & Monitoring For the Indian Ocean Basin Using the NOAA NCEP Climate Forecast System (CFS)	Wassila Thiaw (NOAA CPC)
4:25 – 4:50	The Variability of the African Climate System (VACS) Panel of CLIVAR	CLIVAR Representative
4:50-5:00	Daily Wrap-up & Tomorrow's Plans	Sidney Thurston (DBCP)

AGENDA
Day 3: Wednesday 4 May 2011
Science and Resource Planning,
Begin Observation Development Team/Modelling Development Team Breakout Sessions

TIME	SUBJECT	LEAD
9:00-9:10 *Bois de Rose*	**Daily Planning**	Sidney Thurston (DBCP)
9:10-11:00	Science and Resource Planning Meeting: Science	Lisa Beal (SCOR)
11:00-11:30	**Morning Tea Break**	
11:30-1:00	Science and Resource Planning Meeting: Resources	David Vousden (ASCLME)
1:00-2:30	**Buffet Lunch -** Move to Observation Development Team (ODT) and Modelling Development Team (MDT) Breakout Rooms	
2:30-5:30 *Bois de Rose*	SCOR Working Group Meeting	Arne Biastoch (IFM – GEOMAR), Lisa Beal (RSMAS)
2:30-5:30 *Niaouli*	**MDT Capacity Building:** NCEP Climate Forecasts System (CFS) and the Global Forecasts System (GFS)	Wassila Thiaw (NOAA)
2:30-5:30 *Cypres*s	**ODT Capacity Building:** Observing network implementation and data Assembly: RAMA, XBT, Drifters, Voluntary Observing Ship (VOS) Project	Bill Burnett (NOAA/NDBC), Regional Port Meteorological Officers
3:30-4:00	**Afternoon Tea Break**	
5:30-5:40 *Bois de Rose*	Joint Daily Wrap-up & Tomorrow's Plans	Sidney Thurston (DBCP)
6:00-8:00 Location TBA	Social Evening and Deploy "Adopt-A-Drifter"www.adp.**noaa**.gov	GLOBE, NOAA and the University of Mauritius

AGENDA
Day 4: Thursday 5 May 2011
Observation Development Team/Modelling Development Team Breakout Sessions

TIME	SUBJECT	LEAD
8:45-9:00 *Bois de Rose*	Daily Planning	Sidney Thurston (DBCP)
9:00-1:00 *Bois de Rose*	**MDT Capacity Building:** Introduction to Ocean Modeling	Arne Biastoch (IFM – GEOMAR), Pierrick Penven (IRD)
9:00-1:00 *Cypres*s	**ODT Capacity Building**: Remote Sensing	Graham Quartly (NOCS)
10:30-11:00	**Morning Tea Break**	
11:00-1:00	ODT and MDT Breakout Sessions Continue	
1:00-2:30	**Buffet Lunch**	
2:30-5:30 *Bois de Rose*	**MDT Capacity Building:** Operational ocean forecasting	Gary Brassington (BoM)
2:30-5:30 *Cypres*s	**ODT Capacity Building:** Regional Data Networks and Accessibility	Mike Roberts SA/DEA, Johan Stander SAWS, Jean-François Ternon IRD
5:30-5:40 *Bois de Rose*	Joint Daily Wrap-up & Tomorrow's Plans	Sidney Thurston (DBCP)

AGENDA
Day 5: Friday 6 May 2011
Building Capacity - Regional Resourcing & Coordination

TIME	SUBJECT	LEAD
8:45-9:00 *Bois de Rose*	Daily Planning	Sidney Thurston (DBCP)
9:00-1:00 *Bois de Rose*	**MDT Capacity Building**: Seasonal Forecasting and SINTEX-F After teabreak: A discussion on planned modeling activities in the region to result in a 3 page document of activities and key contact people	Wataru Sasaki (JAMSTEC), Tomoki Tozuka (University of Tokyo)After tea Juliet Hermes and all other lecturers
9:00-1:00 *Cypres*s	**ADT Capacity Building:** Integration, access to, and ecosystem/ community application of [ASCLME] ocean observing and monitoring data, information, analysis	David Vousden (ASCLME)
10:30-11:00	**Morning Tea Break**	
11:00-1:00	ODT and MDT Breakout Sessions Continue	
1:00-2:30	**Buffet Lunch**	

2:30-3:30 *Bois de Rose*	**Joint Symposium Panel:** Interactions Between In-Situ And Satellite Observations & Modelling For Economic Applications	Nick D'Adamo (IOC, Perth)
3:30-4:30 *Bois de Rose*	**Joint Symposium Panel**-Future Plans **:** Coordinating Plans For The Resourcing And Development Of Regional And National Initiatives And Their Use For Policy And Decision Making	Sidney Thurston (DBCP)
4:30-5:30 *Bois de Rose*	**Joint Workshop Wrap-Up-**Logistics Debrief, Lessons Learned And Recommendations For Future Regional Workshop	Sidney Thurston (DBCP)

AGENDA
Day 6: Saturday 7 May 2011

Scientific Committee on Oceanic Research (SCOR) Working Group 136
On Climatic Importance of the Greater Agulhas System

TIME	SUBJECT	LEAD
9:00-11:00 *Niaouli*	**SCOR Wrap Up Meeting**	Lisa Beal and SCOR Members

Models Development Team (MDT):

- Wassila Thiaw (NOAA CPC)
- Juliet Hermes (SAEON)
- Arne Biastoch (IFM-GEOMAR)
- Pierrick Penven (IRD)
- Tomoki Tozuka (U Tokyo)
- Wataru Sasaki (JAMSTEC)
- Representatives (SAWS)
- et al

Observations Development Team (ODT):

- Graham Quartly (NOCS)
- M. Ravichandran (MoES)
- Mike Roberts (SA/DEA)
- Francois Carnus (AMESD)
- Rezah Badal (MOI)
- Johan Stander (SAWS)
- Bill Burnett (NOAA)
- Tommy Bornman (ASCLME)
- et al

Models Development Team Themes:

- Climate Forecasting System
- Operational Data Analysis
- Tools for Analysis
- Ocean and Atmospheric Modeling

Observation Development Team Themes:

- Remote Sensing
- Data Assembly, Assimilation, and Analysis
- Regional Observations
- ASCLME Observation Data
- Extreme Events