WORLD METEOROLOGICAL ORGANIZATION

THE WORLD WEATHER WATCH PROGRAMME

THE STRATEGIC PLAN TO ENHANCE THE CONTRIBUTION OF WORLD WEATHER WATCH TO THE REDUCTION OF THE RISKS ASSOCIATED WITH SEVERE WEATHER AND CLIMATE EXTREMES AFFECTING AFRICA IN SUPPORT OF SUSTAINABLE DEVELOPMENT

A contribution to the reduction of the impacts of severe weather and climate extremes in Africa, March 2006

TABLE OF CONTENTS

TABLE OF CONTENTS 1
1.INTRODUCTION 3
1.1 Background 3
1.2 The Visions Of African Leaders and WMO 8
1.2.1 The Vision Of African Leaders 8
1.2.2 The vision of WMO 9
1.3 The Status Of World Weather Watch Basic Systems In Africa 9
2. THE UPDATED STRATEGIC PLAN TO IMPROVE WWW BASIC SYSTEMS ... 14
2.1.PURPOSE 14
2.3 STRATEGIES 15
2.3.1 Strategy 1:To Improve Facilities and Human Resources Required for Efficient Gathering, Exchange and Processing of Meteorological Observations, Data and Products 15
2.3.1.1 Improve the implementation and operation of observation networks 15
2.3.1.2 Improve data gathering and exchange 16
i. National Level: 16
ii. Regional and sub-regional: 16
2.3.1.3 Reduce operation costs of NMHSs 16
2.3.1.4 Enhance Data Processing and Forecasting, Public weather Services and data management Facilities 17
2.3.1.5 Capacity Building 17
2.3.2 *Strategy 2: To Improve the Delivery of Accurate and Reliable Warnings of Severe Weather and Climate Extreme Events.* 17
2.3.3 Strategy 3: To Enhance the quality and Timely Availability of Forecasts, Advisories and Warnings oo the Governments, Individuals and Industries 18
2.3.4 Strategy 4: To Enhance the Capacities of NMHSs to Develop Tailor Made Products to Support the Social and Economic Development of The Region 19
2.3.5 Strategy 5:To Mobilize Resources to Implement the Strategy 19
3.POTENTIAL PROJECTS 19
3.1 Project 1: Enhancing the contribution of NMHSs and RSMCs to the reduction of risks associated with severe weather and climate extremes affecting Africa in support sustainable development. 20
3.1.1 Overview 20
3.1.2 Objective 20
3.1.3 Activities 21
3.2 Project 2:Enhancing the Contribution of NMHSs and RSMCs to the Reduction of Risks in Agriculture and Water Sectors Associated with Severe Weather and Climate Extremes in Support Of Food Security and Water Availability in Africa 21
3.2.1 Overview 21
3.2.2 Objective 21
3.2.3 Activities 22
3.3 Project 3: Enhancing the contribution of NMHSs and RSMCs to the reduction of risks in the transport and communication (aviation, marine, road and rail) sectors associated with severe weather and climate extremes in support of safety, trade and tourism in Africa. 22
3.3.1 Overview 22
3.3.2 Objective 23
3.3.3 Activities 23
3.4 The Benefits of the Proposed Projects 23
4. POSSIBLE COLLABORATORS AND SOURCES OF FUNDING 24
5. IMPLEMENTATION 24
6.CONCLUSION 24

THE STRATEGIC PLAN TO ENHANCE THE CONTRIBUTION OF WORLD WEATHER WATCH TO THE REDUCTION OF THE RISKS ASSOCIATED WITH SEVERE WEATHER AND CLIMATE EXTREMES AFFECTING AFRICA IN SUPPORT OF SUSTAINABLE DEVELOPMENT

1.INTRODUCTION

1.1 Background

Africa is a continent frequently affected by natural disasters majority of which are related to severe weather and climate extremes. The frequent transformation of the hazards related to severe weather and climate extremes into disasters affecting the region is a threat to the safety of life and property, and retards the social and economic development of the region. The recent severe weather and climate extremes that affected parts of the region include the floods and droughts experienced in eastern and southern Africa, during period 1997-2000 associated with the period1997/1998 El Nino and 1998-2000 La Nina events. The distraction of infrastructure associated with these events was enormous and would take a long time to replace. The events also led losses of lives and affected large numbers of the population. The region is also frequently affected by tropical cyclones, dust storms, strong winds, frost and disease outbreaks. The responses to these severe weather and climate extremes consume the available local and international resources leaving very little to promote development. Table 1 shows that in the year 2005 alone almost all corners of Africa were under a threat of a particular severe weather or climate extreme emphasizing the need to improve the quality and reliability of warnings of severe events related to weather, water and climate their impacts on the related natural environment in support of safety of life and protection of property, and to stimulate development for the improvement of the well-being of the community in the region. This would be very much in line with the multibillion-dollar UN System-wide Special initiative on Africa launched in 1990 aimed at accelerating African development by addressing issues related to health care, and water and food security amongst others. All these needs are affected by climate extremes and the improvements of early warning systems would significantly contribute to the achievement of the intended objectives. In West Africa, the permanent interstate committee for drought control in the Sahel (CILSS), created in 1973 had a responsibility to address drought and desertification.

Table 1: Severe weather and climate extremes experienced in some parts of Africa in the year 2005-2006 as obtained from the Internet and media reports.

PERIOD	**COUNTRY**	**TYPE OF HAZARD/ EFFECTS**	**PEOPLE AFFECTED**	**ESTIMATE COST**
August 2005	Central Africa Republic	Floods	20,000	US$ 18,000 For Flood Relief
September 2005	Mauritania	Floods	Unkown	Unknown
October 2005	Zimbabwe	***Drought*** -Shortage of Water and Food	Over 1M	Unknown
October 2005	Swaziland	***Drought*** -Famine	Unknown	Unknown
August 2005	Senegal	***Floods*** -Malaria Cholera.	46 died of Cholera. Over 183,000	US$96.5M Needed to relocate 60,000 people
September 2005	Namibia	***Drought***	Unknown	Unknown
September 2005	Cameroon	***Drought*** -Famine	250, 000	US$ 2M needed for emergency rations.
September 2005	Niger	***Drought***	3M	Unknown
2005	Kenya	***Drough***t –Famine	3.5M	Unknown

Figures 1 and 2 demonstrate the impacts of these frequent severe weather and climate extremes in the region.

Figure 1: A man marooned by floods in east Africa ((Adopted from DMC-Nairobi).

Figure (1) demonstrates the vulnerability of the rural communities of Africa to the frequent floods affecting the region and the levels of poverty. This situation cannot promote any meaningful development and only leads to enhanced poverty. A single flood destroys all the gains that a person might have made in development over a period of time before the hazard. The situation would even have been worse were it that the National Meteorological and Hydrological Services (NMHSs) were not providing any information to assist in the prevention and management of these kinds of hazards.

Droughts and famine are the other climate related hazards affecting majority of the communities in Africa. Droughts and famine create helplessness rendering the victims totally retarded. The children, women and the elderly are the most affected by these hazards. Figure (2a) demonstrates the desperate situations of the rural poor in Africa caused by drought and famine, which destroys all the natural survival systems.

Figure 2a:An elderly rural person affected by drought and famine breaking wild nuts for a meal (Adopted from DMC-Nairobi).

The person in the photograph has very little hope of survival and has turned to wild nuts to sustain his life. Frequent hunger and famine experienced in parts of Africa affect large fraction of the population and impede development making the region to have the largest numbers of the Least Developed Countries(LDCs) in the world. We cannot stop the occurrence of severe weather and climate extreme events but we can prevent and mitigate the associated impacts through the issuance of timely and skilful early warnings. The surveys conducted in the region indicated that weather and climate information is used to generate early warnings and in making decision to mitigate the impacts associated with severe weather and climate extremes.

The quality and the efficiency to generate and exchange forecasts on which the early warnings are based is highly depended on the efficiency of the World Weather Watch(WWW) programme that facilitates the development, operation and enhancement of worldwide systems for observing, processing and exchanging meteorological data, information and products. The strengthening of the WWW facilities in the region would enhance the capacities of the NMHSs of Members and Regional Specialized Meteorological Centres(RSMCs) to deliver accurate and reliable warnings to support efforts to mitigate the impacts associated with severe weather and climate extremes and improve the well being of the rural communities in the region who are the most vulnerable to natural disasters.

Figure 2b:A photograph of Maasai who had lost their animals to drought in the year 2000 (Adopted from DMC-Nairobi).

Figure (2b) is a photograph of Maasai who lost their animals to drought. Africa has a large population of pastoral communities whose lives are wholly dependent on domestic animals. Their survival in a situation that leads to losses of their animals is limited. Figures 1 and 2 emphasize the need for the improvement of the forecasts of severe weather and climate extremes that contribute to these conditions for Africa to realize social and economic growth. The other risks include those related to tropical cyclones, dust storms, lightning and strong winds. The management of malaria, which is a major killer in the region, and other weather and climate related diseases would benefit from the improvements of the forecasts of severe weather and climate extremes since the signals of the causes appear before the outbreaks and can be predicted.

The reduction of risks associated with severe weather and climate extremes provides a more sustainable solution to the reduction of the impacts associated with severe weather and climate extremes, and improvements of the coping mechanisms of the communities at risk. The African Unity/NEPAD comprehensive Africa agriculture development programme recognizes the need to develop information on disasters affecting the food and agriculture sector including the causal factors and impacts. The programme further observes the need to build capacity for forecasting, prevention and mitigation of adverse effects of natural disasters, including droughts; improve water management, capture and store rain water for use in times of drought through simple technologies-water harvesting and ground water recharge; and combat desertification. All these needs can only be achieved through the utilization of meteorological/hydrological observations, data and products.

The responses from the international communities in the form of food relief and provision of other immediate needs do not provide a sustainable solution and continues to contribute to the high levels of poverty in the affected areas since most of the assistance to the vulnerable communities only comes when they are experiencing a disaster. It is not unusual to find it difficult to access resources for reducing the risks associated with severe weather and climate extremes, which often translate into disasters since disaster prevention and mitigation is rarely integrated into development plans and programs. It is encouraging that the region and most of the international funding institutions are starting to recognize the need to support disaster risk reduction taking advantage of the potentials of the vulnerable communities. The visions of African leaders and World Meteorological

Organization(WMO), discussed in the next chapter, are good testimonies of efforts and commitments aimed at natural disaster risk reduction and support to sustainable development.

1.2 The Visions Of African Leaders and WMO

1.2.1 The Vision Of African Leaders

The common vision of African leaders as spelled out in the New Partnership for Africa's Development (NEPAD) includes eradicating poverty and placing the countries, both individually and collectively, on a path of sustainable growth and development and actively participate in the world economy. The NEPAD recognizes that some of the key resources that can be tapped for the achievement of sustainable development of Africa include Agriculture, energy, water, Tourism and Industrial Development. NEPAD also aims at improving the health of the people. Unsatisfactory health conditions due to frequent hunger and famine contribute to significant reduction in the productivity in Africa and economic growth. Natural resources including production in agricultural sector, performance of agrobased industries and disease outbreaks are highly influenced by meteorological and hydrological processes. Rainfall is the single most important element with the highest influence on the development of the region. NEPAD aims at achieving and sustaining an average Gross Domestic Product (GPD) growth rate of over 7% per annum for fifteen years since 2001, and to reduce infant and child mortality rations by two-thirds between 1990 and 2015. It should be recognized that frequent severe weather and climate extremes experienced in the region which are associated with the majority of natural disasters affecting the region may pose a big challenge to the achievement of the projected growth rate and the reduction of infant and child mortality. NEPAD recognizes that weather and climate uncertainties are among the key factors that affect the contribution of agriculture to development. Agriculture contributes significantly to the economy of the majority of countries in the region and improved agricultural production and food security is a goal not only for NEPAD but also the Regional Economic Groups.The Africa Regional Strategy for Disaster Risk Reduction developed in 2004 recognizes that disasters and people affected and economic losses have increased in the region and that development was at risk due to disasters**.**

The achievement of this vision will require the reduction of risks associated with severe weather and climate extremes which are associated with most of the disasters in the region that continue to consume resources leaving little or nothing for investment. It will also require enhanced industrial production. The raw materials and energy for the majority of industries contributing to the social and economic development of the region are influenced by severe weather and climate extreme events. The reduction of losses in the industries would require improvements in the capacities of NMHSs to deliver accurate and reliable forecasts of severe weather and climate extremes affecting the region. The realization of timely and efficient meteorological services in the region would contribute significantly to the desire to realize rapid social and economic growth in the region.

The survey conducted in 2006 revealed that the common focus of Regional Economic Groups (REGs) are agriculture and food security, water resource management, transport and communication, health and trade. All these need weather and climate information for efficient operation and management.

1.2.2 The vision of WMO

The vision of WMO as spelled out in the Sixth WMO Long-term Plan, is to provide world leadership in expertise and international cooperation in weather, climate, hydrology and water resources and related environmental issues, and thereby to contribute to safety and well being of people throughout the world and to economic benefit of all nations. The desired outcomes of the Sixth WMO Longterm Plan are:

i. Improved protection of life and property;
ii. Increased safety on land, at sea and in air;
iii. Enhanced quality of life;
iv. Sustainable economic growth;
v. Protection of environment and
vi. Enhanced WMO effectiveness.

The desired outcomes of the Sixth WMO Longterm Plan took into consideration the needs of WMO Member countries and are intended to contribute to the goals of the Members and international communities to reduce social and economic impacts of ***natural disasters; enhance safety of road transport, air travel and transport, and life and property at sea; improve food security; improve the design, development and management of water resources; improve economic development and protection of environment***. The advances in the science of meteorology and hydrology make it possible for WMO and NMHSs of each Member to provide information and warnings that would support efforts to reduce the risks associated with severe events related to weather, water, climate and the related environment, which contribute to the majority of natural disaster affecting the region.

The WMO has continued to support national Meteorological and Hydrological services of the Members in Africa in the development of infrastructure and human resource required for the provision of services for safety of life and protection property, and to foster sustainable development of the Members. These initiatives are achieved through the various WMO programmes. One of those programmes, which is the key programme of WMO for providing data, forecasts, products, and services for the other WMO programmes, is the World Weather Watch (WWW) discussed in the next section.

1.3 The Status Of World Weather Watch Basic Systems In Africa

The WWW facilitates the development, operation and enhancement of worldwide systems for observing, processing and exchanging meteorological data, information and products. It enables NMHSs of each Member to access information needed to provide effectively services towards improving protection of life and property, increasing safety on land, at sea, and in air, enhancing quality of life, sustaining economic growth and protecting the environment. It is organized as an international cooperation programme with infrastructure, systems and facilities implemented and operated by the WMO Member countries recognizing the need for sharing data and information since no single country can be self sufficient in the provision of all its meteorological and related services due to the nature of weather processes which do not respect geographical boundaries. The main function of WWW are to plan, organize and coordinate the facilities, procedures and arrangements at the global and regional level related to the design of observation and communications networks, the standardization of observing networks and measuring techniques, the use of data, arrangement principles, and the presentation of information in a form and format that is understood by all, regardless of the language. It directly supports international programmes such as Global Climate Observing System(GCOS), Global Ocean Observing System(GOOS) and Global Atmosphere Watch(GAW). It will also

contribute significantly to the realization of the Global Earth Observing System of Systems (GEOSS) initiative.

The WWW is composed of the Global Observing System (GOS), Global Telecommunication System (GTS) and the Global Data Processing and Forecasting System (GDPFS). The GOS consists of facilities and arrangements for making observations at stations on land and at sea, and from aircraft, environmental satellites and other platforms. The GTS consists of integrated networks of telecommunication facilities and services for rapid and reliable collection, and distribution of observational data and processed information and the GDPFS consists of world, regional/specialized and national meteorological centres in order to provide processed data, analyses and forecast products.

The WMO expert meeting on the exchange of early warning and related information including Tsunami warnings in the Indian Ocean held from 16-18 March 2005 in Jakarta, Japan recognized that the GTS, with improvement is capable of meeting the requirements for the distribution in the Indian Ocean of Interim advisory information. The WMO surveys conducted in 2005 in countries affected by the 2004 Indian Ocean Tsunami revealed inadequacies in the GTS especially with regard to Automatic Message Switching Systems (AMSS), and the establishment and operation of the telecommunication links. The cost of operation and maintenance continued to contribute to the weaknesses of the GTS in the region. Djibouti has no message Switching System and is not linked to RTH – Nairobi. The data is fed to the GTS by e-mail. Djibouti receives the GTS data for operation through METEOSAT Second Generation Satellite (MSG) System. The study proposed that the link with Nairobi be established through VSAT. The missions conducted during the period of updating this strategy revealed that the weaknesses in the GTS continued to be the major causes of unsatisfactory availability of data from the region. Some NMCs do not have a reliable link with an RTH. The weaknesses in the national telecommunication networks affect data collection and transmission. The advances in telecommunication technology provide various less costly solutions for the improvement of the GTS in Africa.

The participants of various WMO GDPFS workshops held in the region to develop capacities in Numerical Weather Prediction (NWP) have continued to underscore the need to improve the capacities in NWP and infrastructures required for data gathering, processing and exchange, and operationally running NWP models to improve the skills of forecasting severe weather events affecting the region. The NWP has developed over the years but full utilization of this method in Africa to improve early warnings and forecasts to support public, aviation and marine safety, and development has been frustrated by the sparse data networks, inadequate infrastructures for data collection, processing and exchange, and inadequate human resource capacity. There is an urgent need to develop capacities in this method since it has a high potential in improving the prediction of severe weather events affecting the region. The meetings have also recognized that RETIM and EUMETCAST would help access to NWP products and other information useful for severe weather forecasting in the region at reduced operational costs.

The efficiency of WWW is central to the achievement of most of the WMO goals and those of Members aimed at reducing social and economic impacts of natural disasters; enhancing safety of road transport, air travel and transport, and life and property at sea; improving food security; improving the design, development and management of water resources; and improving economic development and protection of environment. At the 7th Conference on the Management for Development of Meteorological Services in Africa, held from 22-25 November 2004 in Brazzaville, Congo, WMO indicated commitment, in

collaboration with the NMHSs in the region, to continue to play an active role to protect people and property against natural hazards, which contribute to most of the natural disasters affecting the region, reduce poverty, protect the environment, strengthen social and economic well being of all sectors of the Society. The conference registered the need for NMHSs to develop products that would meet the needs of the users including those required for disaster prevention and management, and for socio-economic development. The development of such products, which are highly needed by the region due to frequent disasters experienced, would require the improvements in data availability, processing facilities and human resource capacities. All these interests will require that efforts are made to enhance data gathering, exchange, processing and management which form the core responsibilities of the WWW. The skillful prediction of severe weather affecting the region such as tropical cyclones and severe storms will require the implementation of radar networks to supplement the satellite Remote Sensing data available to the NMHSs.

It has been the desire of NMHSs of the Region to provide information and products that would support the various needs of the Region including Disaster Risk Reduction and Sustainable Development. At the 13 Session of WMO Regional Association – I (Africa) held in Mbabane, Swaziland in October 2002 a strategy aimed at enhancing the data gathering, processing and the exchange of data and products was adopted. The WWW Strategic Plan on the implementation and improvement of the Basic Systems in RA-I Africa has been since then a useful roadmap for the development of the World Weather Watch in the Region. The WMO survey conducted in 2005 through questionnaire and the missions to some countries in 2006 indicated that a number of NMHSs in the Region have continued to implement components of the Strategic Plan through Government funding and external support. The components of the strategy that have continued to be implemented by Members and WMO include:

i. Improvement of observation Networks by installing AWOS, weather surveillance radars and rehabilitating upper air stations;
ii. Improvements of telecommunication Systems by replacing the aging Automatic Message Switching Systems (AMSS) at Regional Telecommunication Hubs and at National Meteorological Centres, and by - acquiring and installing RETIM and VSAT; using internet for data exchange; using cell phones for data collection;
iii. Assessing the capacity of the GTS to exchange data and warnings including Tsunami warnings in the countries neighbouring the Indian Ocean affected by the Tsunami of December 2004;

Iv Acquisition and installation, under the Meteorological Transition in Africa Project (MTAP), equipment with facilities to receive and apply satellite information from the METEOSAT Second Generation Satellite (MSG), which will contribute significantly to the improvements in the provision of information needed for early warnings, food security, health management, efficient water use and safer transport. 45 countries in Africa benefited from this project.

V Enhancing observation networks over the Indian and Atlantic Ocean;

Vi Capacity building in data processing and forecasting including the desire to improve the forecasting of severe weather through demonstration projects and enhancing the capacities of NMHSs to utilize NWP products.

Vii Improving the processing and utilization of seasonal climate outlook by promoting partnerships between NMHSs and users; and

Viii Capacity building in meteorology and related sciences to enhance the capacities of NMHSs

Despite these efforts by Members and WMO, the results of WMO Annual Global Monitoring (AGM) and the Special Main Telecommunication Network Monitoring (SMM) of the operation of the WWW have, over the years, indicated that data availability in the WMO Regional Association-I (Africa) is not satisfactory affecting the delivery of services required to achieve the shared goals of WMO and Members aimed at reducing social and economic impacts of natural disasters; enhancing safety of road transport, air travel and transport, and life and property at sea; improving food security; improving the design, development and management of water resources; and improving economic development and protection of environment ***.***

The availability of data from the region remained lowest among all WMO Regional Associations. The percentage of surface observations (SYNOP) received in 2004 was only about 50% showing no much improvement since the year 2000. The percentage of upper air observations (TEMP) available to Members remained at only about 30%.. The WMO surveys conducted in 2006 during the time of updating the strategy indicated that the observation networks are inadequate to meet the needs of the users, the meteorological telecommunication systems are inadequate to support the rapid exchange of meteorological observations, data and products and the data processing facilities are inadequate to support the timely generation of forecasts and advisories and for processing the various user specific products needed by the users. The human resource capacities are inadequate in NWP, ICT, Instrument fabrication and calibration, and in generating sector specific products. The surveys conducted in the period 2001 and 2006 revealed the various weaknesses in the GOS, GTS and GDPFS in the region that contributed to the unsatisfactory performance of the WWW in the region.

The weaknesses included:

i. The failure to catch up with rapid technological developments;

ii. The poor economic environment and scientific innovation in many African countries;

iii. Difficulties to establish stations in remote or inhabitable areas and large water bodies;

iv. Inadequate funds to rehabilitate and operate equipment;

v. Inadequate personnel caused, in some countries, by the pressure on Governments to reduce its workforce;

vi. Insufficiently trained technical staff to operate and maintain equipment;

vii. Poor telecommunication infrastructure in many African countries;

viii. High telecommunication tariffs and costs of consumables;

ix. Non-automation of NMCs, and lack of facilities and human resource capacities to take advantage of the GDPFS, DM and PWS products including interpretation,

verification, and use of model outputs and data code formats like BUFR, CREX and GRIB;

x. The data in the majority of the countries was kept in paper form or obsolete electronic media and needed rescue and automation;

xi. Lack of legally binding service contracts between the majority of NMHSs and telecommunication service providers; and

xii. Civil strife in some countries.

- Unreliable and unimplemented links between NMCs and RTHs;
- Inadequate funds to rehabilitate and repair and/or replace obsolete telecommunications equipment;
- Many NMCs have non-functional or poor data collection and retransmission facilities;
- Insufficiently trained technical staff to operate and maintain electronic telecommunication equipment;
- Poor telecommunication infrastructure in many African countries;
- High telecommunication tariffs and costs of consumables; and

Lack of legally binding service contracts between the majority of NMHSs and Telecommunication Service Providers.

The deficiencies in the WWW Basic systems continue to lead to lack of observations, delays in the transmission of the available observed data and warnings, inefficiencies in the data processing to provide the highly needed products to address severe weather and climate extremes affecting the region, enhance the safety and economic operation of civil aviation and marine navigation, reduce climate risks in the related industries operating in the region and support formulation of the various development policies and contingency to ensure that the shocks associated with severe weather and climate extremes are reduced in support of sustainable socio-economic development.

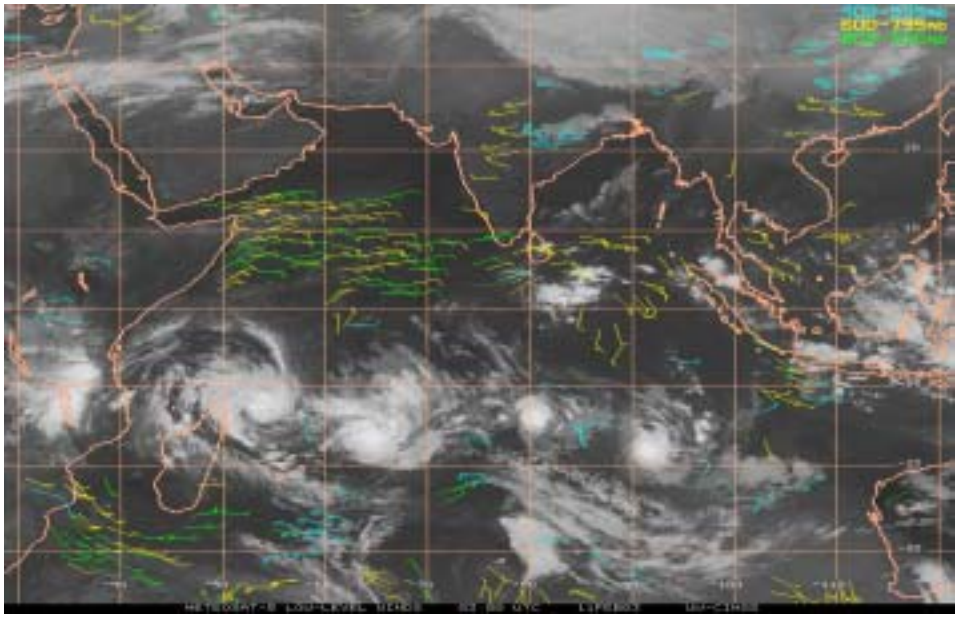

Figure 3: A series of tropical cyclones observed on 11 February 2003(Garry, Hape and Fiona) as was captured by METEOSAT.

Figure (3) displays the potential risks of parts of the region to severe weather and the potential of WWW Basic Systems to monitor, forecast and provide warnings that would support the reduction of the associated risks.

Over the years seasonal climate outlooks issued by Regional and Sub-regional Meteorological Centres in collaboration with NMHSs has become an integral component for disaster prevention and mitigation in the region. These products have shown that skilful forecasts and climate outlooks together with capacities to interpret and apply them can significantly reduce the impacts of severe weather and climate extremes. For example, the 1984 drought over eastern Africa led to more losses of lives than the 1999-2000 drought which was more severe. The reduced losses of life may be attributed to more skillful seasonal climate outlooks issued by NMHSs and RSMCs.

The station networtks, telecommunication networks and the capacities to manage and process data affect the provision of weather and climate forecasts. The confidence of the users in the information and capacity to interpret and apply also contributes to the frequent transformation of hazards affecting the region into disasters.

2. THE UPDATED STRATEGIC PLAN TO IMPROVE WWW BASIC SYSTEMS

The updated strategic plan is aimed at providing solutions to the weaknesses in the WWW Basic Systems to facilitate the provision of quality and efficient services by NMHSs and RSMCs in support of the achievements of the shared goals which include support to safety of life and protection of property, agriculture and food security, water resource development and management, disaster prevention and mitigation, management of disease outbreaks, and the development and management of transport system. It is an update of the RA-I (Africa) Strategic Plan on the Implementation and Improvement of WWW Basic Systems developed by the Heads of NMHSs in the Region in collaboration with WMO in the year 2002. It takes into consideration the visions of African leaders, WMO, NMHSs, communities in Member countries and the international communities aimed at the improvement of the well-being of the people and fostering sustainable development. The proposed solutions for the improvement of WWW are discussed later. In the next section the purpose of this updated strategic plan is discussed.

2.1.PURPOSE

The shared vision of African leaders, WMO, International Communities and NMHSs in the region is to improve the well-being of the humankind and foster sustainable development. Over the years, WMO and Members have made a lot of efforts to develop the science of meteorology and hydrology to support the needs of humankind and protect environment. The science of meteorology and hydrology has grown to high levels that would benefit all sectors of society and economy.

The purpose of this strategic Plan is, therefore, to enhance the contribution of World Weather Watch to the reduction of the risks associated with severe weather and climate extremes affecting Africa in support of sustainable development of the

region. It intends to enable Africa to benefit from the gains in the development of the science of meteorology and hydrology including the other related applied sciences in addressing the threats of severe weather and climate extremes to the well-being of their people and sustainable development. The successful implementation of this strategic plan is expected to enhance the capacities of the society, industries and decision makers to adapt to and cope with the frequent severe weather and climate extremes affecting the region by reducing the risks and taking advantage of opportunities availed by the events.

2.3 STRATEGIES

The improvement of the contribution of the WWW to the **reduction of the risks associated with severe weather and climate extremes affecting Africa** would require the provision of the necessary infrastructure and human resource to avail data, information and products needed by the NMHSs of Members to provide accurate and reliable forecasts. It would also require the enhancement of the capacities of the users to access, interpret and apply the forecasts and advisories provided by NMHSs and RMCs/SRMCs.

The strategies to enhance the contribution of WWW to the reduction of the risks associated with severe weather and climate extremes include:

i. To improve facilities and human resource capacities required for efficient gathering, exchange and processing of meteorological observations, data and products.
ii. To improve the delivery of accurate and reliable warnings of severe weather and climate extreme events;
iii. To enhance the timely availability of forecasts, advisories and warnings to the Governments, Individuals and Industries;
iv. To enhance the capacities of NMHSs to develop tailor made products to support the social and economic development of the region; and
v. To mobilize the resources to implement the strategy.

2.3.1 Strategy 1:To Improve Facilities and Human Resources Required for Efficient Gathering, Exchange and Processing of Meteorological Observations, Data and Products.

The achievement of the goals of this strategy would require the implementation of the following five categories of activities.

2.3.1.1 Improve the implementation and operation of observation networks

a. Acquiring and implementing Automatic Weather Stations (AWS) with Data Collecting Platforms (DCPs) in remote or inhabitable areas and water bodies, where manning of stations is difficult;
b. Reactivating an optimum number of upper air stations by deploying systems using the Global Positioning System (GPS), upgrading of Vaisala ground stations to the RS-92 sonde and any advances in the technology such as glider-sondes, AMDAR etc and ensure continuous operation;
c. Rehabilitating the current station network where possible and implement stations at critical data sparse areas;
d. Acquiring and implementing radar networks to support the forecasts of rapid onset severe events***;***

e. Enhancing access to satellite remote sensing data and relevant application software; and

f. Enhance the capacities of regional instrument calibration centres.

2.3.1.2 Improve data gathering and exchange

i. National Level:

a. *Rehabilitate data collection and retransmission facilities at the NMC**s*** to enhance data gathering and exchange of warnings including Tsunami warnings;
b. Promote the use of advances in telecommunication technology such as digital HF SSB and satellite based facilities free for use by NMHSs such Collection Platforms (DCPs) , EMETCAST, World-space Broadcasts, and RANET;
c. *Promote the use of E-mail and Internet facilities at observing stations to improve data collection, avail e-mail and Internet facilities to rural communities to reduce the digital divide and enhance the visibility* of Meteorological services in remote areas;
d. Support the implementation of Internet access at all NMCs;
e. Acquire and install at NMCs computer based telecommunication systems with *facilities for automatic request and retrieval of data from observing stations; and*
f. Establish links between NMCs and Airports to facilitate the transmission of aeronautical meteorological information.

ii. Regional and sub-regional:

a. *Rehabilitate data collection and retransmission facilities at the RTHs* to enhance the capacities to transmit and receive data and warnings including Tsunami warnings;
b. *Implement the remaining critical non-operational links between NMCs and RTHs*;
c. *Install AMSS equipped with facilities for automatic request and retrieval of data at RTHs to* improve the efficiency of data collection and retransmission, and *reduce the operation costs for data collection and retransmission*;
d. *Deploy VSAT and other technologies for data collection and retransmission*. VSAT is *a robust, flexible and highly reliable system of two-way communication between any two points* (NMCs to RTHs). However, for cost-effectiveness, a sub-regional approach would be appropriate;
e. Promote the use of satellite based systems free for use by NMHSs such as MDD and RETIM for the reception of data and products;
f. *Explore the use of frame relay for data exchange*. Frame Relay Networks are mostly set up by national Telecommunication Service Providers (TSPs) and *enable transmission of high-speed data typically over 256Kbps**.*** The system is highly *efficient in transferring large data files from any point within a TSP point-of-presence in network*. National Meteorological services *can be interconnected on Frame Relay Networks so long as they are within TSP point-of presence as is the case with Telkom South Africa and La Reúnion;*
g. Support implementation of Internet servers at RTHs;
h. Explore the possibility of networking VSAT telecommunication implemented in the region to enhance efficiency of meteorological telecommunication networks in the region; and
i. *Set up sub-regional repair and maintenance centres* for telecommunication facilities to facilitate the sharing of expertise available in the region.

2.3.1.3 Reduce operation costs of NMHSs

i. Promote service contracts for some none core services;
ii. Establish sub-regional centre(s) for equipment fabrication and maintenance;
iii. Provide national and regional capability to produce basic equipment and consumables;
iv. Promote joint procurement of consumables to take advantage of bulk purchases;
v. Build capacity for the operation and maintenance of equipment;

vi. Assess the staffing needs of NMHSs in the region; and
vii. Promote further automation of some functions of NMHSs.

2.3.1.4 Enhance Data Processing and Forecasting, Public weather Services and data management Facilities

a. Acquire and implement the necessary software and high capacity servers for the processing and management of databases;
b. Equip national meteorological centres (NMCs) and Regional Specialized Meteorological Centres(RSMCs) with adequate computer capacity to receive, process and archive meteorological observations and data;
c. Equip NMCs and RSMCs with the relevant software to facilitate the efficient processing of data to provide the much needed user specific products;
d. Equip NMCs and RSMCs with facilities to support the rescuing of data held in obsolete formats;
e. ·To build capacity in ICT, Geographical Information System (GIS) and Climate-modeling;
f. ·Enhance the capacities of RSMCs with potential for NWP by providing high-speed workstations, or PC clusters and servers for running NWP and other Climate models; and
g. ·Upgrade telecommunication and Internet facilities of the NMHSs to access products of RSMCs and exchange products.

2.3.1.5 Capacity Building

i. *Conduct training in the fabrication, operation and maintenance of equipment and instruments*;
ii. Build capacity in instrument calibration;
iii. Conduct Training in the use of new telecommunication techniques;
iv. Conduct training on GTS procedures and ICT for the GTS and WWW development;
***v. Build capacity for GDPS, PWS and DM including the interpretation, verification and use of NWP model outputs and data code formats like BUFR, CREX and GRIB*;**
vi. *Build capacity in weather presentation and dissemination techniques and;*
vii. *Build capacity in GIS and Climate-modeling; and*
viii. *Build capacity in processing and application of remote sensing (satellite and radar) data.*

2.3.2 *Strategy 2: To Improve the Delivery of Accurate and Reliable Warnings of Severe Weather and Climate Extreme Events.*

The achievement of the goals of this strategy would require the implementation of the following activities.

i. To enhance the capacities of NMHSs and RSMCs to generate and disseminate weather and climate forecasts, advisories and warnings
ii. ;
iii. Integrate GDPFS facilities and provide sub-regional and regional institutions and NMCs with the capacity to carry out research to improve the skills of forecasts of high impact severe weather and climate extremes, and operationally issue weather,

climate, and water resources forecasts to support the reduction of risks associated with severe weather and climate extreme events.

iv. Build capacities of NMHSs and RSMCs in Numerical Weather Prediction (NWP);

v. Enhance the research for development facilities and capacities of the African Centre of Meteorological applications for Development (ACMAD), sub-regional centres and NMCs to enable better understanding of regional weather and climate, establishment of climate risk zones and indices for weather and climate monitoring and prediction including the improvements in seasonal to interannual climate predictions;

vi. Building capacity for GDPFS, PWS and DM including the interpretation, verification and use of NWP model outputs, and implementation and use of table driven formats like BUFR, CREX and GRIB;

vii. Promote demonstration projects on the forecasting of severe weather and climate extreme events involving Global, Regional and National Meteorological Centres ;

viii. Develop tools, in collaboration with other sectors, to support the design and implementation of infrastructure and settlements that would withstand severe weather and climate extreme events experienced in the region;

ix. Develop, in collaboration with other sectors, products to enhance human comfort, agricultural production, water resource management, exploitation of renewable energy (hydropower, solar, and wind) and support Governments, individuals and industries to reduce risks associated with severe weather and climate extremes;

x. Enhance the capacities of the users to apply weather and climate information and products by creating awareness and promoting vocational training of the users;

xi. **Promote research for the better understanding and prediction of the weather and climate systems affecting the region;**

xii. **Rescue and automate national and sub-regional databases *and***

xiii. Enhancine new satellite data applications such as monitoring and control of pests, bush and forest fires, rainfall estimation etc.

2.3.3 Strategy 3: To Enhance the quality and Timely Availability of Forecasts, Advisories and Warnings oo the Governments, Individuals and Industries

i. Equip NMHSs and RSMCs with facilities and human resource capability to establish and manage meteorological and hydrological data bases;

ii. Enhance the data coverage and quality by taking advantage of advances in meteorological observation technology and processing software;

iii. Equip NMCs and RSMCs with equipment, software and human resource capacities to facilitate speedy exchange of information of information and products;

iv. Enhance the capacities of weather recording studios and simplify the terminologies used in weather bulletins;

v. Promote the training in broadcast and media meteorology to enhance the capacities of the journalists and meteorologists to disseminate weather forecasts and warnings;

vi. Work with EUMETSAT to identify products that could be included on EUMETCAST broadcast programme as was the case for the operation of Meteorological Data Distribution(MDD) system;

vii. Improve national meteorological telecommunication networks to facilitate rapid exchange of forecasts and warnings including Tsunami warnings;

viii. Improve telecommunication facilities at rural meteorological stations by taking advantage of advances in telecommunication technology including internet, EUMETCAST, RANET, Worldspace programmes and RETIM to facilitate the rapid dissemination of warnings to the vulnerable rural communities;

ix. Promote partnership with Armature Radio Operators and

x. Enhance partnership with users, media and community elders to facilitate wide dissemination of forecasts and warnings;

2.3.4 Strategy 4: To Enhance the Capacities of NMHSs to Develop Tailor Made Products to Support the Social and Economic Development of The Region

i. Assess the needs of users and develop relevant products.

Enhance the capacities of NMHSs in data processing including the efficiency to manage databases so as to make them user friendly;

xi. Enhance the capacities of NMHSs and RSMCs to package and brand meteorological and hydrological services to ease identification, access, and application;
ii. Promote the development and inclusion of the Meta Data of NMHSs on their respective websites;
iii. Build the capacities of NMHSs to generate and package specialized products that meet the needs of specific sectors;
iv. Conduct surveys to identify user needs and generate appropriate products; and
v. Promote research for the better understanding and prediction of the weather and climate systems affecting the region.

2.3.5 Strategy 5:To Mobilize Resources to Implement the Strategy

The achievement of the goals of this strategy would require the implementation of the following activities.

i. **To promote partnerships with users by conducting workshops, conferences and seminars on topical issues aimed on reducing risks in the relevant sectors;**
ii. To enhance the capacities of NMHSs to market their services and products;
iii. To enhance partnership between the NMHSs\and sectors influenced by weather and climate to promote joint approach in acquisition and installation of infrastructures required to provide relevant services;
iv. To enhance joint research among NMHSs and RSMCs and international institutions on relevant issues of interest to the Region and Members;
v. To promote the inclusion of the aspects of this strategy in Regional and National Strategies for the development of the NMHSs and sectors depended on meteorological and hydrological services including the:
    a) Disaster Risk Reduction Strategies;
    b) Safety in aviation, marine and road transport; and
    c) Poverty Reduction and Wealth Creation Strategies.

3.POTENTIAL PROJECTS

The reduction of risks associated with severe weather and climate extremes is a major concern of countries in the region since such risks and associated disasters continue to retard development, and lead to hunger and famine, absolute poverty and losses of life and property. A lot of resources are frequently used in the region to address the impacts associated with severe weather and climate extremes. The effects of Tsunami of December 2004 brought another angle to disaster risk reduction, which called for the rapid exchange of warnings including Tsunami warnings and the GTS was identified to facilitate the exchange of Tsunami warnings. The suggested potential projects address the identified concerns in totality including linkages with infrastructure and observations required to achieve the intended goal of reducing risks associated with severe weather

and climate extremes in the region and contribute to sustainable development. The products from the projects are expected to contribute to the shared major development goals of the region which include**:**

i. Agriculture and Food Security;
ii. Water Resource development and Management;
iii. Transport and communication;
iv. Trade and industry;
v. Disaster Prevention and management;
vi. Poverty Reduction and wealth creation; and
vii. Environmental protection and Management.

The potential projects include:

i. Enhancing the contribution of NMHSs and RSMCs to the reduction of risks associated with severe weather and climate extremes in support sustainable development;
ii. Enhancing the contribution of NMHSs and RSMCs to the reduction of risks in agriculture and water sectors associated with severe weather and climate extremes in support of food security and water availability in Africa, and
iii. Enhancing the contribution of NMHSs and RSMCs to the reduction risks in transport and communication (aviation, marine, road and rail) sectors associated with severe weather and climate extremes in support of safety, trade and tourism in Africa.

3.1 Project 1: Enhancing the contribution of NMHSs and RSMCs to the reduction of risks associated with severe weather and climate extremes affecting Africa in support sustainable development.

3.1.1 Overview

This is a broad project that addresses the capacities of NMHSs, RSMCs and users to meet the needs of the people of Africa in regard to:

i. Safety of life and protection of property;
ii. Poverty reduction through enhanced production and trade;
iii. Food security and water availability and
iv. Disaster risk reduction.

3.1.2 Objective

The overall objective of this project is to enhance the capacities of NMHSs and RSMCs to generate products to support the reduction of the risks associated with severe weather and climate extremes affecting the region in support of sustainable development. The specific objectives include:

i. To improve facilities and human resource capacities required for efficient gathering, exchange and processing of meteorological observations, data and products;
ii. To improve the delivery of timely, skillful and reliable warnings of severe weather and climate extreme events;
iii. To enhance the timely availability of forecasts, advisories and warnings to the Governments, Individuals and Industries; and

iv. To enhance the capacities of NMHSs to develop tailor made products to support the social and economic development of the region

3.1.3 Activities

The project activities include:

a. Improve observation station networks, telecommunication networks and data processing facilities;
b. Improve instrument calibration facilities at regional instrument calibration centres;
c. Build human resource capacities for data quality control, instrument calibration and fabrication, the development and maintenance of data bases, and for the maintenance of meteorological instruments and equipment;
d. Enhance human resource capacities in NWP, empirical Climate prediction, dynamical and empirical climate diagnosis and application software;
e. Enhance interactions with users through seminars, conferences, workshops and joint research aimed at developing the products that meet the needs of users; and
f. Enhance the utilization of RANET, EUMETCAST, RETIM and World space broadcasts to enable the rural meteorological stations and users have access to information to support the reduction of the risks associated with severe weather and climate extremes.

3.2 Project 2:Enhancing the Contribution of NMHSs and RSMCs to the Reduction of Risks in Agriculture and Water Sectors Associated with Severe Weather and Climate Extremes in Support Of Food Security and Water Availability in Africa

3.2.1 Overview

Food security and water availability are the two major concerns of interest for the entire region as reflected in the goals of various strategic plans in the region. Frequent hunger and famine affecting the region poses a major challenge to the achievement of sustainable economic growth and a healthy continent. The fluctuations of water availability associated with climate variability are equally a threat to the development of the region since hydropower is the major source of energy used by industries.

The development and application of relevant hydrometeorological and agrometeorological information and products together wth the prudent practices in agriculture and water sectors emphasizing on the integration of weather and climate information into the operation and management of the sectors would significantly contribute to the reduction of weather and climate related risks in the sectors and enhance crop yields and industrial production. Improved weather and climate forecasts would help in the planning of activities in the sectors and mitigation of negative impacts of severe weather and climate extremes.

3.2.2 Objective

The overall objective of this project is enhance the capacities of NMHSs and RSMCs to generate products that would contribute to the reduction of weather and climate related

risks in agriculture and water sectors in support of sustainable development. The specific objectives include:

i. To develop qualitity and skillful forecasts and advisories that meet the needs of the sectors;
ii. To enhance the access to agrometeorological and hydrometeorological information;
iii. To enhance the application of weather and climate forecasts and advisories in the design, development and management of activities in agriculture and water sectors.

3.2.3 Activities

i. Conduct assessments to establish the immediate needs of meteorological information in agriculture and water sectors;
ii. Improve agrometeological and hydrometeorogical observation station networks and facilities;
iii. Improve forecasting capabilities by enhancing capacities in NWP and empirical forecasting methods;
iv. Improve telecommunication and data processing facilities to enhance the availability and quality of data, products and warnings relevant to the sectors;
v. Improve the skills of weather and climate forecasts relevant to agriculture and water resource management;
vi. Improve the capacities of NMHSs and RSMCs to acquire and utilize the various application software to enhance the quality of services to the sectors;
vii. Enhance the capacities to package and simplify weather and climate forecasts;
viii. Conduct pilot demonstration projects on the benefits of integrating weather and climate forecasts into the management of the sectors; and
ix. Build the capacities of the users to utilize information from NMHSs and RSMCs through awareness raising workshops.

3.3 Project 3: Enhancing the contribution of NMHSs and RSMCs to the reduction of risks in the transport and communication (aviation, marine, road and rail) sectors associated with severe weather and climate extremes in support of safety, trade and tourism in Africa.

3.3.1 Overview

Transport and communication sectors have been observed to be important for the promotion of integration of the Region and Subregions and for the promotion of trade. The goals of the Region and Subregions for development share the need to improve transport and communication. Aviation, marine, road and rail transport dominate the modes of transport in the region. All these modes of transport are affected by severe weather and climate extremes, and need meteorological information to reduce the risks associated with severe weather and climate extremes in support of safety, economic operations and trade.

Efforts are being made in parts of the region to upgrade airports, construct transnational road networks and improve marine activities including port services. These improvements require similar improvements in meteorological services to meet the needs of the upgrades. Improvements in meteorological services would include enhancement in the capacities for observation, data gathering, exchange and processing, dissemination of

information and warnings including Tsunami warnings, and fabrication and calibration instruments. The design and development of transport and communication infrastructure require meteorological information to minimize the impacts of severe weather and climate extremes.

3.3.2 Objective

The main objective of this project is to enhance safety and economic operation in the transport and communication sectors. The specific objectives are:

i. To improve the safety of landing and taking off at airports;
ii. To improve the safety of long flights,
iii. To improve the safety of navigation in neighbouring oceans and inland lakes;
iv. To improve the safety of road and rail transport;
v. Provide the information for the design and implementation of airports, roads, rails and telecommunication facilities.

3.3.3 Activities

i. Conduct assessments to establish the immediate needs of meteorological information in the transport and communication sectors;
ii. Acquire and install AWS at airports;
iii. Enhance observation networks through the deployment of AWS;
iv. Rehabilitate strategic upper air stations;
v. Replace the aging automatic message switching systems at RTHs and NMCs;
vi. Improve national and regional meteorological telecommunication facilities;
vii. Enhance the capacities of regional instrument calibration centres;
viii. Improve forecasting capabilities by enhancing capacities in NWP and empirical forecasting methods; and
ix. Improve the capacities of NMHSs and RSMCs to acquire and utilize the various application software to enhance the quality of services to the sectors;

3.4 The Benefits of the Proposed Projects

The benefits of the proposed projects include:

i. Enhanced capacities of NMHSs, RICs and RSMCs to meet the ever increasing needs of the region for disaster risk reduction;
ii. Improved protection of life and property;
iii. Reduced resources used for the management of disasters related to severe weather and climate extremes that could be deployed in activities that would foster development and reduce poverty;
iv. Reduced vulnerability of the communities and sectors dependent on climate;
v. Enhanced productivity in weather and climate dependent sectors;
vi. Reduced risks in water and agriculture sectors in support of improved yields and water availability; and
vii. Enhanced safety on road, in air and at sea to promote trade and tourism.

4. POSSIBLE COLLABORATORS AND SOURCES OF FUNDING

Governments of the Region
International development partners
World Bank
European Commission
ICAO
UNISDR
UNDP
USAID
DFID
FAO
UNEP
Arab Bank
African Development Bank

5. IMPLEMENTATION

The implementation of this strategy will require involvement of stakeholders, which include the Regional Economic Groups, international Governments and Organizations, supporting parts of Africa in activities affected by high impact severe weather and climate extremes. The first level of involvement would be to discuss their development interests in Africa and assess the adequacy of coverage in the revised strategy. Once the interests of the stakeholders are integrated in the strategy, the following activities may be considered:

i. Present the revised strategy to WWW-B and relevant WMO programmes;
ii. WMO presents the revised strategy to the President of the WMO Regional Association-I;
iii. The WMO association adopts the revised strategy;
iv. Involve AU and REGs to integrate their needs into the revised strategy;
v. Inclusion of aspects of the regional strategies dependent on WWW e.g. Food Security, Disaster Risk reduction and water resource management;
vi. Hold a financing conference with potential funding institution and Sub-Regional Economic Groups and NEPAD; and
vii. The strategy be communicated to Governments as a roadmap for the development of services in the region for WMO and Members to contribute more efficiently to the reduction of disaster risks, reduction of poverty and support sustainable development.

6.CONCLUSION

The risks associated with severe weather and climate extremes are a major challenge for the achievement of the various development goals of the region but are often forgotten until a disaster strikes. We cannot stop the occurrence of severe weather and climate extremes but we can mitigate the associated impacts and prevent disasters by taking advantage of the advances in the science of meteorology and hydrology. This strategy provides a comprehensive list of activities that would contribute to the reduction of weather and climate related risks and promote the development of the region. The successful implementation of this strategy will require political goodwill, enhanced collaboration and the strengthening of NMHSs, RICs, RTHs and RSMCs.