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Template for Creating a Sustainable Framework for Climate Services in Africa

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BIO SKETCH
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Dr. Semazzi has served in several senior positions of scientific organizations in the US, Europe, and Africa. He was a lecturer in the department of meteorology at the University of Nairobi, Kenya; Research Associate Scientist at NASA Goddard Space Flight Center, Greenbelt Maryland; US National Science Foundation (NSF) Climate Dynamics Program Associate Program Director, Washington DC; Founding Director of Climate Information & Prediction Services Program of the World Meteorological Organization at the United Nations, Geneva Switzerland; Senior Scientist, World Climate Research Program (WCRP) CLIVAR International Project Office, Southampton, England; & Professor at North Carolina State University, Raleigh, North Carolina. Dr. Semazzi has served in capacities of editor & author for the Intergovernmental Panel on Climate Change (IPCC) climate change assessment. In March 2009 he received a certificate of special recognition from Dr. Rajendra K. Pachauri, Chairman of IPCC for distinguished contribution resulting in the award of the Nobel Peace Prize for 2007 to the IPCC. This recognition was extended, '*... only to those who have contributed substantially to the work of the IPCC over the years since the inception of the organization...*'. Dr. Semazzi is a member of the Joint Scientific Committee (JSC) for the World Climate Research Programme (WCRP; 2009-2012). WCRP is sponsored by the World Meteorological Organization, the International Council for Science (ICSU) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO. Dr. Semazzi has authored over sixty scientific publications & served as principal investigator on twelve research grants, with total funding of more than \$18 million.

ABSTRACT

An embryonic framework now exists through the RCOF process supported by the WMO CLIPS program for the provision of climate services in Africa. However, the major advances which have been made in climate science research during the recent decades have had limited impact on improving climate services and enhancing social-economic conditions in Africa. It is therefore important at this time of the eminent establishment of the Global Framework for Climate Services (GFCS) to examine the reasons for this important discrepancy and devise appropriate mechanisms to address this problem. Although the lack of human capacity, technological resources and the necessary infrastructure are critical for addressing the climate change problem, we believe the root cause is the existence of a self-sustaining cycle which is continuously eroding and undermining any progress. This cycle begins with poor support and funding for research and climate services. These result in the inability of climate services providers to meet stakeholder needs therefore further eroding of support and perpetuating the cycle.

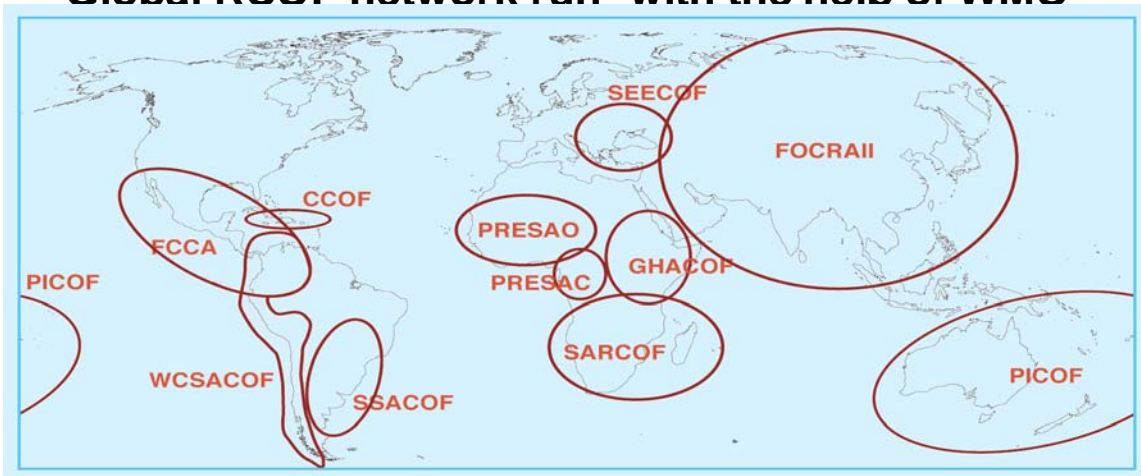
We propose an alternative approach that would break this cycle and give way for the creation of a new pool of stakeholders for climate services in Africa who will use and advocate for funding and other forms of support for the relevant research and its outcomes. We propose a framework for the development of Climate Risk Management Strategies (CRMS) to support climate services in Africa. This framework comprise three components, namely, implementation sites for the CRMS incubation projects, a CLIVAR (Africa)-CLIPS Joint Task Force joint Task Force (TF) for guiding the relevant cross-cut research and a WMO/WCRP system-based administrative office for coordinating the day-to-day management of CRMS agenda. This framework can also be extended to other RCOF regions in the World.

Key words: CLIMATE SERVICES, CLIVAR, CLIPS

1.0 INTRODUCTION

A central focus of the Global Framework for Climate Services (GFCS; see appendix C) which is in the process of being established is to promote the integration of climate information into development planning to enhance the performance of climate-sensitive social-economic sectors. The problem regarding the provision of climate services in developing nations is compounded by inadequate human capacity, lack of technological resources and the necessary infrastructure to support in-country climate services.

Global RCOF network run with the help of WMO



1. GHACOF: Greater Horn of Africa COF
2. SARCOCF: Southern Africa COF
3. PRESAO: Western Africa
4. COPRESAC: Central Africa COF
5. FOCRAII: Forum On regional Climate monitoring, assessment and prediction for Regional Association II (Asia)
6. SSACOF: Southeast of South America COF
7. WCSACOF: Western Coast of South America COF
8. CCOF: Caribbean COF
9. FCCA: Foro Regional del Clima de América Central
10. PICOF: Pacific Islands COF
11. SEECOF: South Eastern Europe COF

Fig. 1: Global RCOF network run with the help of WMO (see appendix A)

An embryonic framework exists through the RCOF seasonal climate programs (appendix A) run

with the help of WMO to support the GFCS framework in Africa (Fig.1). Regarding the creation of an effective end-user interface RCOFs have excelled in achieving this particular objective since the first activities were launched about 12 years ago. However, the climate information products fall far short of the end-user needs in terms of resolution, timing of the products for seasonal prediction, and relevance of climate information products required by specific users. As a result, a major portion of the climate information generated for the RCOFs is not useable by the application sectors. The problem is compounded further by the prevalence of the ‘donor mentality’ and the need to make transformation to the ‘owner mentality’. In a broader social-economic context this problem has been eloquently analyzed in a book by Carol Lancaster (reviewed by Ankomah, 2003). She advocates for the need to build the capacity of aid giving agencies themselves to enable them to direct aid that makes donor support recipients in Africa the owners of the programs contrary to the current donor driven approach. Without building their capability, it is impossible to ensure that African nations will be able to develop their own capacity for economic, social and political growth. This transformation is also needed for the climate science research and services in Africa. We apply this principal to motivate the proposed CRMS framework.

At the other end, although numerous research studies have been carried on the global climate through WCRP (Fig.2) and other avenues, the impact of these advances on the social-economic conditions in the Africa is still very limited. The recent 10-year anniversary RCOF review (Semazzi et al, 2010) has identified several non-traditional areas of climate research required to support the integration of climate information into developmental planning for improving the performance of climate-sensitive sectors.

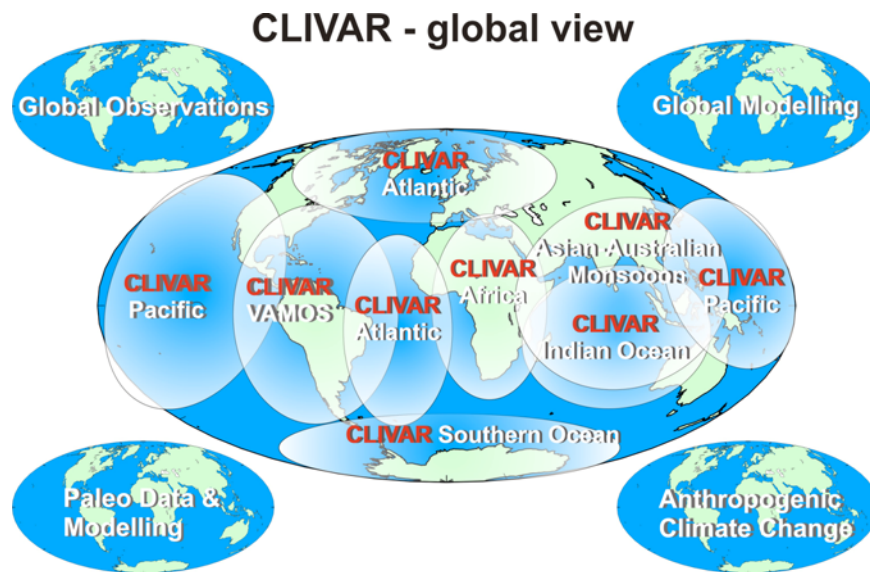


Fig. 2: WCRP global CLIVAR project (<http://www.clivar.org>)

As a result of the disconnection between research activity and climate services a self-sustaining cycle which is continuously eroding and undermining any progress has materialized. The cycle begins with poor support and funding for research and climate services. This results in inability of climate services providers to meet stakeholder needs which then results in the further erosion of support and strengthening of this positive feedback process. In this paper we propose a framework aimed at helping climate services providing institutions in Africa to concretely demonstrate the benefits of climate research and climate services thereby breaking the cycle and creating stakeholders for the climate services who will use and advocate for funding of research and its outcomes.

2.0 TEMPLATE FOR CREATING A SUSTAINABLE FRAMEWORK FOR CLIMATE SERVICES

To address these gaps we propose an organizational structure and implementation strategy in the WMO/WCRP/GFCS system that will support a long-term sustainable program for the incubation

of Climate Risk Management Strategies (CRMS; Fig.3) for decision making in Africa. The design of CRMS is aimed at supporting an effective end-user-centered communications strategy, including delivery, consultation and results monitoring. CRMS organizational structure and implementation strategy comprise the following components:

- I. RCOF Centers (or RCCs; see appendix C) serving as implementing sites for the CRMS incubation projects,
- II. CLIVAR (Africa)-CLIPS Joint Task Force (TF) for guiding the relevant cross-cut research,
- III. WMO/WCRP/GFCS system administering office to coordinate day-to-day management of the CRMS agenda

3.0 MISSION & IMPLEMENTATION SITES FOR THE CRMS AGENDA

The mission of the proposed CRMS research program is to create knowledge enterprise zone for a dedicated multidisciplinary community, of university, industry and government partnerships to design, test, and operationalize climate risk management strategies for greater quality of life in the regions served by the CRMS program and the hosting institutions.

The most natural implementation sites for the CRMS agenda are the RCOF centers or RCCs in Africa. We envisage that this will entail formation of interdisciplinary teams of 5 to 10 people working together continuously for a few months up to a year to develop practical strategies for climate risk management. Members of these teams would come from advanced research & climate services centers around the world, universities, and participants from NMHSs, RCC permanent personnel, and representatives of the application sector. The outcomes generated by these teams would be migrated to the main stream operational RCC environment in much shorter

time than would have otherwise been possible. The intent is that the high-impact risk management strategies produced by these teams will encourage developing nations to invest in climate science research by increasing and sustaining support for in-country research activities for managing climate risk and increasing the performance of climate-sensitive social-economic sectors. This would have the important effect of breaking the ‘cycle’ through concrete demonstration of the value of climate services & therefore promote the atmosphere conducive for sustained funding and support for further investment in this enterprise.

CRMS should have three distinct attributes, (i) fostering interdisciplinary research and assessment synthesis; (ii) improving our understanding of and bridging the gap between climate science research and applications; and, (iii) contributing to regional decision support and climate services. Other attributes will include:

- CRMS will provide a pathway for GFCS’s integration of adaptation actions into development plans in African nations,
- CRMS will provide streams of valuable feedback and information for evaluating added value of the model prediction products. It will support the building of sustainable partnerships between Universities/Research Institutions & RCCs to accelerate the assimilation of research into operational climate services.
- CRMS will support integrated, place-based research to support decision makers’ options in the face of climate change and variability at the regional level,
- CRMS will do this in a manner that is cognizant of the context of the decision-makers & within the constraints they face in managing their climate sensitive resources,

- A successful CRMS project requires innovative and embedded long-term partnerships among a spectrum of interested parties including national, district, and private entities,
- CRMS will demonstrate partnership among institutions focused on the region and built on existing efforts within the region to study the impacts of climate in support of climate services,
- Partnership with CRMS efforts must: a) involve stakeholders in the design and assessment of the research; and b) develop and communicate innovative and transferable methods, knowledge, information, and/or tools for understanding and adapting to a changing climate.

This test-bed will serve as a mechanism for the creation, dissemination and exchange of climate-related research findings and decision support resources critical for understanding and addressing resource management challenges in user sectors.

4.0 CLIVAR (Africa)-CLIPS JOINT TASK FORCE

The TOR should be based on the joint resolution passed by the experts representing the World Climate Research Program (WCRP) and the WMO Commission for Climatology (CCI), who met in a Joint Session on 18 February 2010 at Antalya, Turkey. The full statement is provided in appendix D.

Framework for Research Incubation Projects

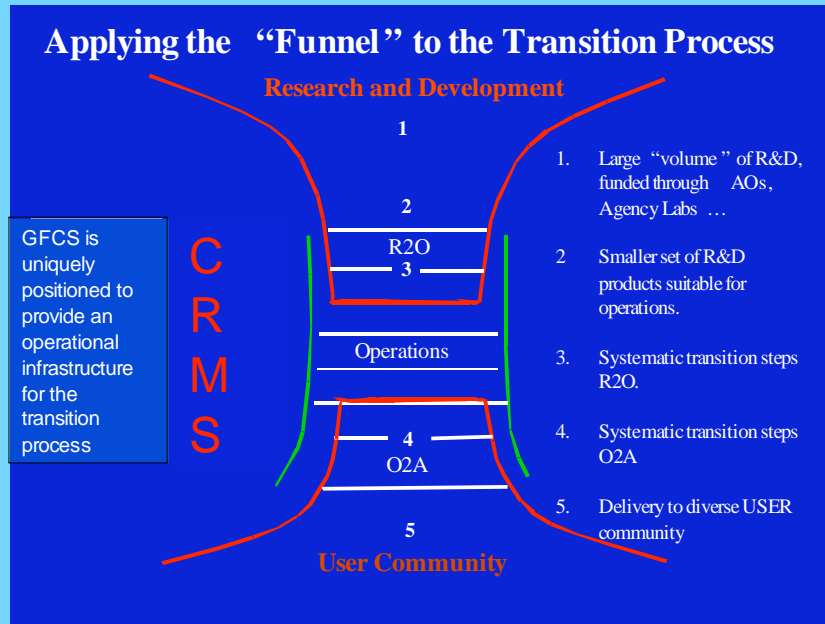


Fig. 3: Design of CRMS ‘test-bed’ (illustration adapted from NOAA CTB framework)

5.0 CRMS COORDINATION FRAMEWORK

The CRMS initiative requires dedicated administrative arrangements or a project office to coordinate and run its day-to-day activities. More specifically, coordination is required to implement the decisions and recommendations made by the proposed CLIVAR (Africa)-CLIPS Joint Task Force (TF). Secondly, administrative coordination is required for streamlining the presently uncoordinated but highly complementary climate-application projects. Many of these projects are in essence incubation projects for the purpose of developing capacity to use climate prediction and projections information to enhance the performance of climate-sensitive sectors.

However, these projects are of short-term duration and their intended impacts could diminish with time. The CRMS project will therefore play a critical role of promoting long-term sustainability for these test-bed projects to integrate climate science into developmental planning actions for climate-sensitive social economic sectors. The ongoing short-term initiatives will provide critical guidance and foundation for the development and implementation of the proposed CRMS project. A short list of recent or ongoing projects and potential partners of the CRMS initiative are listed below (for further details the corresponding web links are provided in brackets and in the references):

- (i) The International Development Research Centre (IDRC; Canada) & Department for International Development (DFID, United Kingdom): The research focuses on Climate Change Adaptation in Africa (CCAA) and capacity development (see IDRC/DFID, reference).
- (ii) SysTem for Analysis Research and Training (START): Supports research that contributes to understanding global environmental change in the context of regional and national development priorities (see START, reference).
- (iii) ICPAC WMO-World Bank demonstration project: Conducting a test-bed climate observations and regional modeling study for the development and support of climate risk management and sustainable development (see ICPAC, reference).
- (iv) UCAR Africa Initiative (UAI): Building a sustainable partnership between UCAR and African Institutions in order to pursue research and applications for the benefit of the African people (see UAI, reference).

- (v) NCSU Africa Meningitis Belt Project: A prototype Earth-gauging system UCAR Google initiative, the NCSU Climate Modeling Laboratory is performing dynamical downscaling of operational forecasts for the West Africa region to support the meningitis vaccination campaign (see NCSU, reference).
- (vi) UCAR-Google Project: To build and implement a prototype decision-support system that integrates weather & climate forecasts and epidemiological data to provide actionable information that can be used to contain the spread of meningitis epidemics (see UCAR-Google, reference).
- (vii) Bill & Melinda Gates; The United Nations World Food Programme (WFP) and the International Fund for Agricultural Development (IFAD) have launched a joint initiative with the Bill & Melinda Gates Foundation which aims to help provide poor rural farmers with financial protection following natural hazard events. Under the initiative, the foundation is providing funding to support the research and planning for insurance schemes designed to help shield small farmers from the impact of natural disasters and climate change (see Bill-Melinda Gates, reference).
- (viii) Korea International Cooperation Agency (KOICA); In 2009, WMO launched a project, funded by Korea International Cooperation Agency (KOICA), to strengthen the capacity of ICPAC to perform RCC functions for the Greater Horn of Africa (GHA) region, and to help GHA countries to use the outputs (see ICPAC, reference).
- (ix) Climate for Development in Africa (ClimDev-Africa) Initiative. To enhance the technical ability and expertise of African climate scientists to generate the necessary climate information to assess climate risk and quantify climatic trends. The project will also generate climate risk assessments of vulnerabilities and impacts on the continent;

improve regional climate forecasts and outlook forums, and down scale climate scenarios and projections appropriate for development on all scales (see ClimDev Africa, reference).

- (x) Others include, USAID, EU, FEWS/NET, UNEP, IRI, Universities, United Kingdom Meteorology Office, NOAA, NASA, NGOs & others which are not listed.

The CRMS project will provide a global framework for long-term sustained coordination of many activities similar to the examples above.

6.0 HUMAN RESOURCES & CRMS PROJECTS

Expertise will be required in regional dynamical climate modeling, statistical modeling, computing technicians, information technology, Web expertise and social communication. Besides the dedicated permanent RCC staff an important element of human capacity are the visiting ‘interdisciplinary teams’. These special teams comprising of 5 to 10 participants will comprise visiting researchers and representatives from RCC member countries who will be responsible for the development & testing of the new strategies for the provision of regional or in-country climate services. A successful CRMS program will require creation of a sustained visitation & exchange collaboration program between partner institutions in developed countries and RCCs through the CRMS incubation activities. Examples of potential CRMS projects include:

- Development of seasonal forecasting ensemble prediction methodologies based on input from the multiple GPCs (at least 11 models) in RCOF tercile format and other forms optimized for climate information end-user forms.
- Modernization of the traditional RCOF forecasting model and blending it with GPC-based experimental prediction products for operational purposes.

- Development of climate risk management & decision model products for a broad range of RCC stake holders.
- Development of self-configurable RCM-based downscaling systems to minimize abuse of RCMs
- Development of Virtual RCOF options to the traditional semi-qualitative RCOF model.

7.0 CONCLUSIONS

We have proposed a new mechanism that will break the cycle that inhibits growth in climate services in Africa. We have proposed a structure that exploits existing capabilities for the development of Climate Risk Management Strategies (CRMS) to support climate services in Africa. This mechanism comprise three components, namely, implementation sites for the CRMS incubation projects, a CLIVAR (Africa)-CLIPS Joint Task Force joint Task Force (TF) for guiding the relevant cross-cut research and a WMO/WCRP/GFCS-based system for coordinating the day-to-day management of the CRMS agenda.

APPENDIX-A: RCOF PROCESS

The RCOF process in typically includes the following components (<http://www.wmo.int/pages/prog/wcp/wcasp/RCOFReview2008.html>):

- Meetings of the regional and international climate experts to develop a consensus for the regional climate outlook using national, regional and global information, typically in a probabilistic form;
- The actual Forum which involves climate scientists, representatives from the user sectors as well as the media, for identification of impacts and implications, and the formulation of response strategies;
- A training workshop on seasonal climate prediction to strengthen the capacity of the national and regional climate scientists;
- Special outreach sessions involving media experts, to develop effective communications strategies.

The consensus prediction process that underlines RCOF operations consists of the following elements:

- Determine the critical time for development of the climate forecast for the region in question;
- Assemble a group of experts:
 - Large scale prediction specialists,
 - regional and local climate applications and forecast/downscaling specialists,
 - stakeholders representative of climate-sensitive sectors;

- Review current large scale (global and regional) climate anomalies and the most recent forecasts for their evolution;
- Review current climate conditions and their impacts at local, national and regional levels, and national-scale forecasts;
- Considering all factors, produce a forecast with related output (e.g. maps of temperature and precipitation anomalies) that will be applied and fine-tuned (downscaling) by NMHSs in the region to meet national needs;
- Discuss, with active involvement of stakeholders representatives of climate-sensitive sectors, applications of the forecast and related climate information to climate-sensitive sectors in the region; consider practical products for development by NMHSs;
- Develop strategies to effectively communicate the information to decision-makers in all affected sectors;
- Critique the session and its results:
 - document achieved improvements to the process and any challenges encountered,
 - establish steps required to further improve the process for subsequent sessions,
 - verify the previous year forecast and evaluate its use,
 - undertake some training session (in new techniques and methods)

APPENDIX-B: GLOBAL FRAMEWORK FOR CLIMATE SERVICES (GFCS)

The WCC-3 adopted a High Level Declaration to establish a Global Framework for Climate Services (GFCS; Fig.4) to strengthen the production, availability, delivery and application of science-based climate prediction and services. The Declaration requested the Secretary-General of the WMO to convene an Intergovernmental Meeting of Member States of WMO to approve the terms of reference and to endorse the composition of a High-level Taskforce (HLT) of

independent advisers. The Declaration further decided that the Taskforce should prepare a report, including recommendations for proposed elements of the GFCS as well as for the next steps to develop and implement the GFCS.

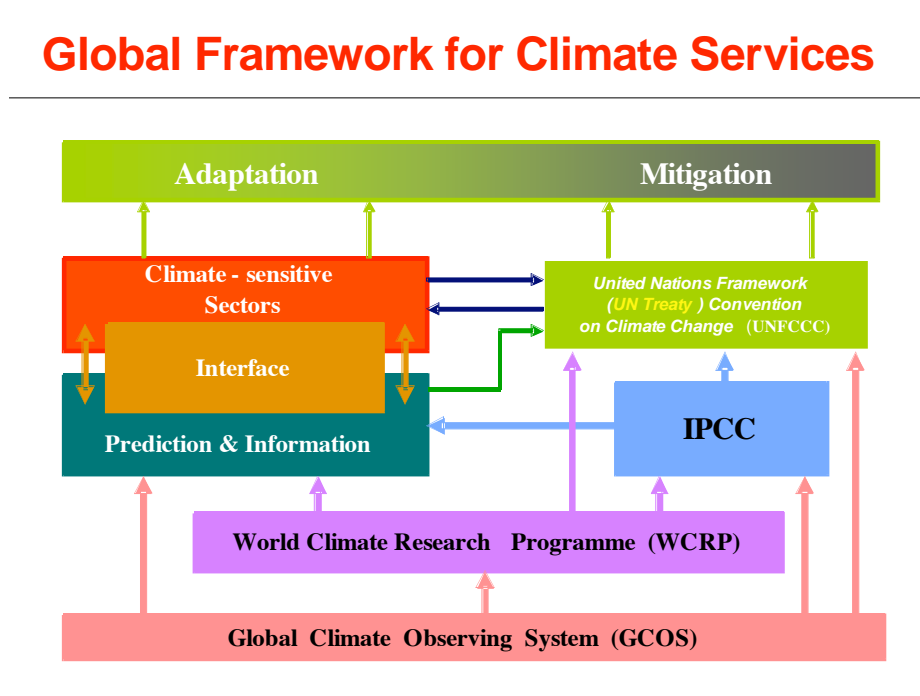


Fig.4: Wiring diagram for design GFCS

The experts have called for major strengthening of 5 essential elements of a global framework for climate services:

1. The Global Climate Observing System and all its components and associated activities; and provision of free and unrestricted exchange and access to climate data;
2. The World Climate Research Program, underpinned by adequate computing resources and increased interaction with other global climate relevant research initiatives

3. Climate services information systems taking advantage of enhanced existing national and international climate service arrangements in the delivery of products, including sector-oriented information to support adaptation activities;
4. Climate user interface mechanisms focused on building linkages and integrating information, at all levels, between the providers and users of climate services; and
5. Efficient and enduring capacity building through education, training, and strengthened outreach and communication.

APPENDIX-C: Regional Climate Centers (RCCs)

WMO is in the process of establishing Regional Climate Centers (RCC) to provide support in fulfilling the need for regionally focused climate services, primarily based on products from the Global Producing Centres (GPCs) for Long-range Forecasts (up to 2 years), years to decades predictions (2 years to decades), and climate change projections (decades to centuries). Some of the RCCs will emerge from the current RCOF centers such as ICPAC. RCCs will provide information to nationals in the region and assist them in delivering appropriate climate services and products including regional long-range climate forecasts for user groups in health, agriculture, tourism, energy, water resource management, disaster risk reduction, urban and building planning and design, transportation, fisheries, forestry, etc. They will also help to strengthen capacities of National Meteorological Services to meet national climate information needs of various users in different sectors. RCC's must comply with certain requirements in order to qualify (reference).

The RCC Research and Development Functions are:

- (i) Develop a climate Research and Development agenda and coordinate it with other relevant RCCs

- (ii) Promote studies of regional climate variability and change, predictability and impact in the Region
- (iii) Develop consensus practices to handle divergent climate information for the Region
- (iv) Develop and validate regional models, methods of downscaling and interpretation of global output products
- (v) Develop and validate regional models, methods of downscaling and interpretation of global output products
- (vi) Promote the use of proxy climate data in long-term analyses of climate variability and change
- (vii) Promote application research, and assist in the specification and development of sector specific products
- (viii) Promote studies of the economic value of climate information

APPENDIX-D: Statement by Joint Session of WMO Commission for Climatology and Joint Scientific Committee for the WCRP, Antalya, Turkey, 18th February, 2010.

We, the experts representing the World Climate Research Programme (WCRP) and the WMO Commission for Climatology (CCI), having met in a Joint Session on 18 February 2010 at Antalya, Turkey, have deliberated on a number of issues of common interest and agree that our joint efforts are critical to comprehensively address the rapidly emerging societal needs for climate services for adaptation and risk management.

The World Climate Conference-3 (WCC-3), held from 31 August to 4 September 2009 in Geneva, decided to establish a Global Framework for Climate Services (GFCS) to strengthen the production, availability, delivery and application of science-based climate monitoring and prediction services. GFCS is designed to mainstream climate science into decision making at all levels and help ensure that every country and every climate-sensitive sector of society is well equipped to access and apply the relevant climate information. GFCS is proposed to have five major components: (i) Observations of the Climate system; (ii) Climate research, modelling and prediction; (iii) a Climate Services Information System; (IV) a Climate User Interface Programme; and (v) Capacity Building.

WCRP has successfully laid the scientific foundation for the current and future climate services. Its research projects, particularly those pursuing the coupled climate and Earth system models, are poised to push the frontiers of climate predictability further. It is recognized that while climate science has advanced significantly during the past three decades, many scientific challenges still remain. Climate research, including understanding, modelling and prediction aspects, helps characterize climate variability and change and to generate quantitative climate predictions and climate projections, on a range of time and space scales, providing a key pillar for the GFCS.

CCI has worked over the years through the World Climate Programme (WCP) and its components (WCASP: World Climate Applications and Services Programme; WCDMP: World Climate Data and Monitoring Programme) to support provision of climate services, including WMO's Climate Information and Prediction Services (CLIPS) project. Climate Services Information System (CSIS), as a component of GFCS designed to deliver the climate information that users need, will be based on the three-tiered structure of entities at global, regional and national levels that have been initiated, developed and promoted through collaborative efforts of CCI and Commission for Basic Systems (CBS). They include Global Data Centres and Global Producing Centres of Long

Range Forecasts (GPCs) and other global climate prediction centres, Regional Climate Centres (RCCs) and other regional institutions, National Meteorological and Hydrological Services (NMHSs) and National Climate Services (NCSs), and would be required to be expanded and strengthened under GFCS.

To support the successful implementation of GFCS, WCRP and CCI agree to closely collaborate to address the following topical issues of direct relevance to climate adaptation and risk management in general and the GFCS in particular:

1. Strengthen and mainstream research observations to serve as prototypes for future climate observing systems, in cooperation with GCOS;
2. Develop climate prediction systems with lead times from seasons to centuries;
3. Ensure development of reliable high-resolution products needed for climate adaptation and risk management;
4. Promote interdisciplinary research to develop sector applications, tools and tailored information;
5. Facilitate flow of user requirements to the research community and climate services producers through user feedback;
6. Support the RCCs, NCSs and the Climate Outlook Forums (COFs) mechanism as well as consensus assessments (Annual State of the Global Climate);
7. Foster links between WMO Regional Associations (RAs), NMHSs, WCP, CCI and WCRP, for regional and national activities
8. Improve the availability of highly-skilled talent to undertake climate research, operational prediction, and communication in Africa;

Having benefited from collaboration between WCRP and CCI in the past and in order to further strengthen this collaboration to achieve the above objectives, the WCRP and CCI agree to establish a joint collaborative mechanism and will seek further partnership with other WMO. Technical Commissions, Programmes, co-sponsored Programmes, and other Research entities. The cooperative mechanism will include e.g. attendance to respective high level bodies of each entity (WCRP JSC, CCI sessions), organization in common of climate-related events (CCI Technical Conferences, WCRP Open Science Conferences), Joint Expert Teams on issues of common interest (such as the successful existing Joint CCI/CLIVAR/JCOMM ETCCDI), joint publications, etc.

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ACRONYMS

AFDB: African Development Bank
CLIPS: Climate Information and Prediction Services
CBS: Commission for Basic Systems
CRMS: Climate Risk Management Strategies
CLIVAR: Climate Variability and Predictability
ClimDev Africa: Climate for Development in Africa
DFID: Department for International Development (UK)
GPC: Global Producing Centres of Long Range Forecasts
EU: European Union
FEWS/NET: Famine Early Warning Systems Network
GHA: Greater Horn of Africa
GCOS: Global Climate Observing System
GFCS: Global Framework for Climate Services
IDRC: International Development Research Centre
IRI: International Research Institute for Climate and Society
IFAD: International Fund for Agricultural Development
KOICA: Korea International Cooperation Agency
NCSU: North Carolina State University
NMHSs: National Meteorological and Hydrological Services
NCSs: National Climate Services
NOAA: NOAA - National Oceanic and Atmospheric Administration
NASA: National Aeronautics and Space Administration
NGOs: Non-governmental organization
RCCs: Regional Climate Centers
RCOF: Regional Climate Outlook Forum
RCC: Regional Climate Centres
START: SysTEM for Analysis Research and Training
TF: Joint Task Force joint Task Force
UCAR: University Cooperation for Atmospheric Research
UAI: Africa Initiative
UNEP: United Nations Environmental Programme
UK MET OFFICE: United Kingdom Meteorological Office
USAID: United States Agency for International Development
WCRP: World Climate Research Program
WMO: World Meteorological Organization
WCP: World Climate Programme
WCASP: World Climate Applications and Services Programme;
WCDMP: World Climate Data and Monitoring Programme
WFP: World Food Programme