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CLIMATE AND ENVIRONMENTAL SERVICES FOR DEVELOPMENT

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ABSTRACT

This paper discusses Climate and Environmental Services for development for Africa as a component of the ClimDev Program. Despite the growing understanding of the climate and its potential impacts on society, climate information is still not routinely useful in decision making. A mechanism is needed that connects the relevant climate science to decisions that build resilience to climate change and variability. While we cannot be prescriptive about specific services for individual countries, there are factors that each of these services should have in common. In particular, informed decision making is based on a wide range of physical and social science information. Acquiring it requires cooperation between many institutions across many disciplines and across national boundaries. It depends on forging new partnerships between the traditional providers of environmental information and between the users and beneficiaries of this information. At present few, if any, countries provide comprehensive national climate and environmental services so there is no obvious single institutional model on which to base the development of these new services.

We consider the specific needs of development and propose a framework to enhance cooperation between all stakeholders. New organizational mechanisms are possible because of the African Union, the Economic Commission, and the Development Bank, which provide a strong framework to establish, nurture and grow pan Africa institutions.

INTRODUCTION

Climate science has made major advances in the past twenty years from seasonal prediction to understanding anthropogenic climate change. At the same time there is growing awareness of the adverse impact of climate on society, especially within developing economies. Climate change risk reduction is a priority for development. This requires adequate monitoring and dissemination programs at the national level to assess risks (Stern 2006), and the institutional capacity to develop the national capability to transform climate data, which will enable governments to include climate information in economic development programs.

Africa is particularly vulnerable to reduced agricultural production, worsening food security, greater exposure to climate-sensitive diseases, increased incidence of

floods and droughts, and conflicts over scarce water resources (APF 2007). In other words, climate change is the major threat to growth and development in Africa. This has led to the ten-year programme "Climate Information for Development Needs: An Action Plan for Africa" (CLIMDEV), which was initiated by the Global Climate Observing System (GCOS) and is now being implemented by the Joint Secretariat of the African Union (AUC), the African Development Bank (AfDB) and the UN Economic Commission for Africa (UNECA) (GCOS 2006).

These first steps lay the foundation for more informed policy and economic decisions aimed at mitigating the adverse consequences of climate change on sustainable development and poverty reduction. There are four main components of the programme: raising policy awareness; undertaking climate risk management; providing climate services; and upgrading and enhancing observations, data management and infrastructure (GCOS 2006). Implementation of this programme will increase the use of climate information and enable societies to be better prepared for the projected impacts of climate change.

The purpose of this paper is to contribute to the debate on how societies can obtain relevant information needed to make informed decisions that reduce their vulnerability to adverse impacts of the climate and environment. We asked ourselves the following questions: What decisions are societies trying to make? What data are needed? How are these data obtained and how are they transformed into useful information? Who are the stakeholders and how do they cooperate, if at all, with each other? Are new institutions needed? For example should each country develop a National Climate and Environmental Service and, if so, would these services be based on existing institutions or would something completely new be needed?

THE DECISION MAKING DILEMMA

We talk frequently about stakeholders and their needs, but who are they really and what is at stake? Put simply, all of us and nearly every facet of our lives[1]. Climate shapes the natural environment and thereby constrains human development. We are especially vulnerable to the availability of water and have difficulty coping with floods and droughts, which disrupt and displace millions of people each year with long term adverse consequences for economies and security. Reducing the vulnerability of a society to the environment in which they live is a key element of sustained development. Our inability to make climate information relevant often results in underestimates of risk and inadequate preparedness and response to natural environmental hazards, which lead inevitably to human disasters. While no society is immune, developing countries, which lack resilience are particularly vulnerable and can be setback decades if they are not prepared to cope with future environmental hazards (Van Aalst 2006).

Thus the question we must address is how do we make climate information more accessible and useful for all of us from the individual family member to a country's top decision makers? Criticism is often leveled at developers for poor construction planning in the wake of floods or farmers during periods of drought for failing to take into account climate information. In the absence of a dedicated Climate Service where do these and other stakeholders go to obtain reliable climate forecasts?

There is a bewildering plethora of sources – multiple government agencies; university departments and institutions; private companies; national, regional and international organizations; some sector specific and others providing general climate and environmental information. The list is very long. The diversity of sources of data and information reflects both the growing need for climate information and the absence of a defined structure to support climate services in most countries.

WHY NATIONAL CLIMATE SERVICES ARE NEEDED

Discussing the issue in the context of the United States, Miles et al. (2006) suggest that a National Climate Service should exist to promote science to support decision-relevant questions, to translate new climate information into relevant decision environments, and to build national and district level capacity to anticipate, plan for, and adapt to climate variability and change. In other words, we need climate forecasts and we need to be prepared for the projected impacts of climate variability and change.

The National Research Council identified the following five guiding principles for climate services (NRC 2001):

[1] Stakeholders and users are used interchangeably and refer to all sectors of society that use weather, climate and related environmental information (e.g., agriculture, development, energy, health, industry, insurance, media, transport, and the general public)

1. The activities and elements of a climate service should be user-centric.

2. If a climate service function is to improve and succeed, it should be supported by active research.

3. Advanced information (including predictions) on a variety of space and time scales, in the context of historical experience, is required to serve national needs.

4. The climate services knowledge base requires active stewardship.

5. Climate services require active and well-defined participation by government, business, and academe.

Specifically, according to Miles et al. (2006), a Climate Service would increase societal resilience to climate impacts by providing the following:

1. Understanding of climate trends and variations as well as possible.

2. Understanding of the impacts of climate on human and non-human systems

3. Decision support tools based on that information, and

4. Increasing society's capacity to act on that information.

It is difficult to argue against the need for increased societal resilience to climate, yet no country has developed a Service capable of delivering the tools needed (cf. Miles et al. 2006, NRC 2001, Changnon et al. 1990). Thus we cannot simply apply a successful template from one country to another. Rather, we will consider how to construct a Climate Service from the various institutions that contribute something to one or more of the elements of a Climate Services defined above.

DEVELOPING NATIONAL CLIMATE SERVICES WITHIN AFRICA

Climate Services should be national services because every part of a country is affected by climate variability and change. A National Climate Service exists to serve national needs related to enhancing economic development, managing risk, protecting life and livelihoods, and promoting environmental stewardship (NRC 2001).

From the scientific perspective, it is easiest to think of a climate service as an extension of a country's National Meteorological or National Hydrometeorological Service. However, a climate service is a much larger undertaking, which involves a broader partnership of producer and user organizations, scientists and social scientists. It requires: interlinked global, national and regional observing systems; comprehensive modelling and analytical capability to be able to downscale global and national information to address problems at regional and local scales; and a distributed decision-relevant research and application capability. It is the latter, in particular, that sets it apart from an exclusively science based service, such as weather forecasting. An effective National Climate Service is one that is focused on collaborative problem solving. This means a service, which is fully engaged with the user to produce mutually defined climate information that is most useful for individual applications. For development, in particular, there is a need for climate change risk assessments to be part of a government's economic planning. Therefore this component of a climate service would be integral to a ministry of finance and planning or even the office of the prime minister or president so that climate information can be used to manage to the risks to public sector investment (see, for example, Bettencourt et al. 2006). Institutionally, this component would be a National Center for Climate and Development, which would focus on policy decisions (Dinku 2007).

Each African country needs a National Climate Service, which identifies, produces, and delivers authoritative and timely information about climate variations and trends and their impacts on built and natural systems on regional, national and global space scales. This information informs and is informed by decision making, risk management, and resource management concerns for a wide variety of public and private users acting on regional, national and international scales (Miles et al. 2006) African nations need national climate services to build societal resilience. A National Climate Service is not only an information provider; it must stimulate social learning to increase the capacity of society to act on this information. The functions and services of a National Climate Service are summarized in Table 1 and 2.

The climate information component is quite well developed. Africa already has a number of institutions that provide climate information, although they all need strengthening. These include multinational organizations such as the African Centre of Meteorological Application for Development (ACMAD), the AGRHYMET Regional Centre of the Permanent Interstate Committee for Drought Control in the Sahel (CILSS), the Southern African Development

Community (SADC) Drought Monitoring Centre (DMC) and the Intergovernmental Authority on Development (IGAD) Climate Prediction and Applications Centre (ICPAC); and country specific National Meteorological or National Hydrological Services. Each of these is linked to an extensive, global network of climate information providers, such as the European Centre for Medium Range Weather Forecasts (ECMWF); the International Research Institute for Climate and Society (IRI); the National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) Climate Prediction Centre (CPC); and the Hadley Centre of the UK Met Office, amongst many others.

Less well developed are the applications. The impact of climate variability and climate change on the livelihood of a farmer, on the health of a village, on the availability of water resources and energy supplies for a country, requires environmental information at the appropriate scale. Often, this creates an observing capacity that is highly fragmented with different organizations and communities establishing independent networks for different applications. This fragmentation can lead to gaps in observations, which limit the ability of countries' to provide information on climate trends and adaptation strategies (IRI 2006). While different organizations should continue to provide data for their specific needs, a National Climate Service needs to provide an overarching structure that will significantly increase the utility of these data to manage climate change impacts.

Table 1 NCS functions (after Miles et al. 2006)

1. Integrate global, national, and regional observations infrastructure to produce information and assessments of use to stakeholders
2. Develop models for decision support
3. Perform basic and applied research on climate dynamics and impacts relevant to stakeholders
4. Create and maintain an operational delivery system and facilitate the transition of new climate applications products to NCS member agencies and partners
5. Develop and maintain a dialogue among stakeholders, member agencies, and researchers relevant for planning and decision making
6. Identify climate related vulnerabilities and build the national capacity to increase resilience
7. Represent regional and national climate issues and concerns in regional, national and international policy arenas and facilitate communication on NCS needs and performance
8. Outreach to stakeholder groups

Stakeholder/user interactions with information providers have developed in a largely unstructured manner, generally user-driven and limited to the specific requirements of a single entity. Some climate sensitive sectors have developed their own climate support services, for example, the International Federation of the Red Cross and Red Crescent Societies (IFRC) have made climate change part of their disaster preparedness and response. They have established their own climate centre to help their staff and volunteers understand and address the risks of climate change (see, for example, the Red Cross/Red Crescent Climate Guide). The health community in Africa has built on the Climate Outlook Forum organized by the DMC in Africa to create the Malaria Outlook Forum, which uses both health and climate information to forecast potential malaria epidemics to better prepare the medical community (Patt et al. 2007). Agriculture and drought control communities have engaged directly with National Meteorological and National Hydrometeorological Services and helped establish regional centres (e.g., AGRHYMET and DMC). Universities in most countries have also developed specialized climate services, which provide decision-relevant research tailored to individual needs; see, for example, the Centre for Science and Technology Innovations (CSTI) at the University of Nairobi, Kenya. Where a national capacity is absent, government departments as well as individual economic sectors often address their problems to the international climate science community.

Table 2 NCS services at the national and regional level (after Miles et al. 2006)

1. Serve as a clearing house and technical access point to stakeholders for regionally and nationally relevant information on climate, climate impacts, and adaptation; developing comprehensive databases of information relevant to specific regional and national stakeholder needs
2. Provide education and training on climate impacts, vulnerabilities, and application of climate information in decision making
3. Create decision support tools that facilitate the use of climate information in stakeholders' near-term operations and long-term planning
4. Provide user access to climate and climate impacts experts for technical assistance in use of climate information and to inform the climate forecast community of their information needs
5. Provide researcher, modeler, and observations experts access to users to help guide research, modeling and observation activities
6. Propose and evaluate adaptation strategies for climate variability and change

One particularly successful decision support application has been the use of climate information by the public health sector to help identify malaria epidemic risk through the cooperation of the health and climate communities (Da Silva et al. 2004). Journalists have also taken an active role in developing climate awareness; for example, the Network of Climate

Journalists in the Greater Horn of Africa (NECJOGHA) plays an active role in educating journalists about climate issues and informing various climate-sensitive sectors of African society.

The strength of a National Climate Service will be in its ability to connect climate scientists with stakeholders at the scales which the local, regional, national and international stakeholders operate.

MANAGING A NATIONAL CLIMATE SERVICE

How should a National Climate Service be managed? Given the institutional arrangements for the delivery of specific environmental services will differ from country to country, we focus on defining the common requirements. While a single governmental institution should lead a National Climate Service, it is inherently a partnership of environmental and social science organizations. Depending on the capacity of a particular country, the leadership might reside in an Environment Agency, a National Meteorological Service, a National Hydrological Service, or similar body. Within the United States, for example, Miles et al. (2006) propose NOAA's Climate Program Office as the lead organization at the national level. Typical governmental partners would include Ministries of Agriculture, Health, Environment, Fisheries, Planning, and Finance. It will be important to draw on existing interests and capabilities across government and across all stakeholders in both the public and private sectors. Intra-governmental cooperation and coordination will require incentives and strong central government leadership with a dedicated budget for Climate Services. It is also important to recognize that many of the human resources needed to operate a National Climate Service will reside in university research departments and that they will continue to play a prominent role in delivering climate services to decision-makers. Integrating these capabilities into a National Climate Service will be a challenge in many countries.

The lead institution would be responsible for combining operational and research activities of multiple agencies into a coherent whole; securing funding for the work of the National Climate Service, negotiating, designing and implementing national observing systems and climate assessments in collaboration with international partners and institutions; and participating in bilateral and international negotiations, coordination and consultations on climate matters. A National Climate Service can and should draw on the wealth of climate and environmental knowledge and expertise that exists in other countries and international institutions.

It is, however, at the regional and local level that services are actually delivered. It is here that interactions with most decision-making stakeholders occur. These stakeholders include the local, state, tribal and resource managers; elected officials; private sector resource managers; non-governmental organizations, research community; and the general public. A National Climate Service will be judged on its relevance and therefore must be completely engaged with its stakeholders. These must play an active role in the overall management of the enterprise, participating directly in institutional governance. The National Climate Service should be evaluated on criteria listed in Table 3.

Table 3 Evaluation Criteria for a National Climate Service

1. Ability to establish and sustain partnerships among and between agencies, researchers, operators and users and how well do those partnerships function at the national and district level..
2. Performance on the quality and relevance of regional research activities to stakeholders
3. Performance on the quality and relevance of decision support and decision support tools
4. Detailed and systematic investigations to document the impact of the Service on regional planning and decision making by user communities

Another important facet in the success of a National Climate Service is international cooperation. This is particularly important where cooperation and coordination can reduce the financial burden of service delivery to all participating countries. It is also important in the design, establishment and operation of a pan Africa climate observing network, which is the shared responsibility of many countries. Efficient and cost effective implementation and management of this system might best be served by a multinational organization of national climate institutions.

One example of a successful organizational model is EUMETNET, the network of European National Meteorological Services, which provides a framework to organise co-operative programmes between its Members in the various fields of basic meteorological activities such as observing systems, data processing, basic forecasting products, research and development, and training. Through EUMETNET Programmes, its Members are able to develop their collective capability to serve environment management and climate monitoring and to bring to all European users the best

available quality of meteorological information. EUMETNET enables them to make more efficient management of their collective resources.

Examples of EUMETNET projects include the Consolidated Observing System (EUCOS), which is designing and coordinating an optimized Europe-wide surface observing network; and the European Climate Support Network (ECSN), which aims, amongst other activities, to provide high quality climate data and products for all of the Members. EUMETNET has the authority and capacity to contract the management of the system to one of its Members via a competitive bidding process. In this way, efficiency is achieved while maintaining collective accountability.

A similar organizational model may also be appropriate for Africa. The backbone of this network could be composed of the National Climate Services and existing regional centers, aligned within the existing economic regions (SADC, ECOWAS, etc.) and under the auspices of the African Union. The network of African National Climate Services, which we might call AUCLIMNET, would be tasked to design the regional observing networks in cooperation with CLIMDEV.

SUMMARY

National Climate Services are an essential instrument in helping to increase the resilience of countries to the adverse effects of climate. These services must encompass a wide range of environmental and social science disciplines to provide the necessary tools to make well-informed decisions. They must draw on the existing expertise from many organizations, while vesting in a single governmental body to coordinate and integrate the climate-related activities. Table 4 summarizes some of the first steps that most countries could undertake to create effective climate services. In the short term, it is particularly important to ensure that climate change risk is factored into public sector investment strategies. Therefore it is important to establish and strengthen the link between climate, development and public policy within the leading government ministries.

CLIMDEV already provides the rationale for the development of climate and environmental services and climate networks. Together AUC, AfDB and UNECA can provide the impetus leading to the formation of National Climate Services. In turn, these would become a mechanism for the implementation of CLIMDEV.

Table 4 First Steps Towards the Creation of a National Climate Service (after NRC 2001)

Improve Capability to Serve National Needs

1. Increase the use of climate information by fostering cooperation and dialogue between government agencies, the private sector and academe.
2. Create user-centric functions within existing agencies to encourage dialogue with users and to adapt existing information to meet user needs. In particular, ensure that climate change risk information is properly integrated into finance and planning departments in developing countries.
3. Support new instrumentation and technology to improve the quality of climate information, especially relevant to the expansion of forecasting and prediction to air quality, hydrology and human health.
4. Empower providers and users to carry out experiments designed to promote and assess the use of climate information
5. Build capacity in long term prediction to provide capabilities in analyzing the limitations and uncertainties, and the impacts of climate change.

Improve Use of a Nation's Weather, Climate and Environmental Observations

6. Inventory existing observing systems and data holdings in all national organizations.
7. Promote efficiency by seeking opportunities to combine observation networks to serve multiple purposes (e.g., weather, climate, water, agriculture, health networks).
8. Create incentives to develop and promote observing networks at the local level throughout a country.
9. Ensure that research accomplishments transition into climate products and services.

Address Societal Needs

10. Make better use of ensemble climate products from major prediction centres to improve impact studies, vulnerabilities and responses.
11. Where appropriate develop regional and local enterprises to expand the nature and scope of climate services to provide a geographical specific focus on societal needs.
12. Increase support for interdisciplinary climate studies at universities and other institutions to increase understanding of societal impacts.
13. Foster climate policy education in universities.
14. Enhance the understanding of climate through public education.

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