

**COPING WITH  
THE CLIMATE:  
A WAY FORWARD**

**SUMMARY AND PROPOSALS FOR ACTION**

A multi-stakeholder review of  
Regional Climate Outlook Forums  
concluded at an international workshop  
OCTOBER 16 - 20, 2000  
PRETORIA, SOUTH AFRICA



**Cover photo (kindly supplied by and copyright to IRI researcher Jennifer Phillips):**

*Farming for household food needs and cash surpluses is a primary task for many women in developing countries. Coping with the climate is an important ongoing task. The cover photo is of a Shona farmer from near the town of Masvingo in south-central Zimbabwe who participated in a three-year survey of farmer use of climate information conducted by Dr. Phillips. In addition to farming and raising goats, she makes these clay pots which she fires in a kiln on her farm and sells in the local market.*



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Seasonal weather and climate fluctuations have significant impacts on society, via agriculture, food security, water, health, natural disasters and the environment. These can be a major brake on economic progress in the developing world. Climate thus sits at the nexus of the two principal development concerns, poverty and sustainable development. Concerns about climate change and the emergence of scientific forecasting of El Niño have set the stage for a fresh approach to addressing the problems of preparing for the coming season and managing climatic risks.



Regional Climate Outlook Forums (RCOFs) were first initiated in 1996 and gained momentum as a regional response to the major El Niño event of 1997/98. Since that time they have rapidly become the main regional mechanism for the formulation and dissemination of seasonal climate forecasts to policymakers and other climate information users. In many regions RCOFs continue to convene regularly before, during, and after key rainfall seasons. Globally more than thirty have been held to date, employing a variety of approaches. The Forums bring together climate scientists, operational forecasters and climate information users to formulate climate outlook guidance and to discuss the implications of probable climate outcomes for climate-sensitive sectors. In the process a substantial amount of experience and knowledge has been gained in the generation, communication and application of seasonal climate information.

This report summarizes the results of a global review of the effectiveness of the RCOFs and related activities. Through an exhaustive stakeholder-driven process, drawing on the experiences of hundreds of organizations, the review has sought to identify key issues, constraints and opportunities for improving the forum process and its contribution to the management of climate variability and change. Proposals are made to advance the goals of the RCOFs to reduce vulnerability to climate variability and change in sensitive regions and sectors.

In 2000, an international review of the RCOFs was launched by a consortium of stakeholders, namely the World Meteorological Organization (WMO), U.S. National Oceanic and Atmospheric Administration (NOAA), U.S. Agency for International Development (USAID), the World Bank, the International Research Institute for Climate Prediction (IRI) and the South Africa Weather Bureau (SAWB). The purpose of the review was to assess the accomplishments and shortcomings of the RCOFs and to contribute to their continued evolution.

The first phase of the review was a comprehensive Preparatory Report contributed by some 30 authors from 11 regions in Latin America and the Caribbean, Africa, Asia and the Pacific. The Preparatory Report documented the experiences in each region; including what worked

and what did not, and summarized the progress and challenges in three thematic areas – climate forecasting, the user interface and sustainability of the RCOFs.

The second phase comprised a workshop in October 2000, in Pretoria, South Africa, in which the authors of the Preparatory Report and 30 other experts and stakeholder representatives met to review the Preparatory Report and to debate and distill the issues identified in it. Analyses and recommendations were produced in four key areas: a) Regional issues, including sustainability, b) Delivery of products and services, c) Technical issues, and d) Capacity building.

The review concluded that the Forums had achieved a great deal in their short period of existence and continued to enjoy high user demand and stakeholder participation, but that significant improvements were required in three linked areas: technical methodology, linkages to users, and financial sustainability. In particular, it was agreed that there is now a clear need to systematically develop and institutionalize the RCOF process and to enhance its interface with users. This will require:

- Systematic expansion of relationships and networks with user communities, especially at the national level, and the development of more user-targeted information
- Active and methodical review and development sessions at all future Forums, as well as mutual interaction and shared learning among the different regional Forums
- Enlargement and mobilization of the global, regional and national stakeholder base, to develop sustainable and user-focused climate forecast services, including the further development of RCOF processes as appropriate.

Specific efforts recommended for the next two years include the organizing and resourcing of working groups, networks and other organizational mechanisms to provide the needed technical assistance and other resources and to explicitly develop a path to sustainability of the Forum processes.

One of the clearest conclusions of the Review was the need to pursue future developments in the Forum process in a systematic, sustained and coordinated manner. To address this, the Review Organizing Committee proposes that a broadly based process of consultation be undertaken among the various stakeholders and initiatives, not only to integrate priorities and programs, but also to more generally define a global alliance to address the overall goal of reducing vulnerability to climate variability and change. The Review Organizing Committee invites governments, policymakers, development experts, scientists and other interested parties to enter into dialogue and associated program development to advance this most promising way forward in the management of seasonal climatic impacts.





## HISTORY OF THE FORUMS AND THE REVIEW

Details on why the Forums were created, the science behind seasonal climate forecasting and the process that was used to review the Forums are given in the following background.

### THE NATURE OF THE PROBLEM

Seasonal weather and climate fluctuations, the most well-known source of which is the El Niño–Southern Oscillation (ENSO) phenomenon, have significant impacts on society, particularly through effects on agricultural production, water supply and the transmission of vector-borne diseases. Climate is a fundamental resource from which substantial benefits flow, but impacts associated with climate variability also account for the majority of all natural disasters, particularly involving floods and droughts. The impacts tend to be disproportionately greater for developing countries, owing to their dependence on natural resources, and to their generally less well-developed infrastructures and lack of alternatives. Intrinsic vulnerabilities to climate are exacerbated by impacts of global change, including population growth and migration, and land use changes and soil degradation. Disasters related to climatic factors place a major brake on asset accumulation and economic progress in the developing world.

Climate sits at the nexus of the two principal development concerns, namely poverty and sustainable development. Efforts to better understand the role of climate on society and to develop ways to manage climate impacts therefore contribute to key development objectives. However, two additional factors add new weight to the case. Firstly it is now recognized that adaptation to seasonal climate variability is also a powerful means for adaptation to climate change. Secondly, there has been a rapid development in the last decade of scientific knowledge about the ENSO phenomenon and other climatic processes that provides a source of advance information concerning future climate anomalies in some seasons and regions. Thus the stage is set for a fresh approach to addressing the age-old problem of preparing for the coming season and managing the impacts of climatic fluctuations as they unfold. It is this problem that is the target of the Regional Climate Outlook Forums.

### EMERGENCE OF THE FORUMS

Public knowledge and perceptions of climate variability and change have grown considerably over the last few decades — people today have a more global understanding than ever before of the nature of the climate and its impacts on society, economies and the environment. This is partly due to the major ENSO event of 1997–98, which was without doubt the best recorded and most analyzed such event in history.



The 1997–98 event, coupled with ever-growing concerns about potential climatic changes associated with global warming, has contributed to unprecedented levels of public awareness and an increasing desire to better anticipate and manage climate fluctuations.

Regional Climate Outlook Forums have become the principal vehicle for providing advance information about the likely character of seasonal climate in several developing regions. The process of organizing the Forums was formally initiated at the Workshop on Reducing Climate-Related Vulnerability in Southern Africa (Victoria Falls, Zimbabwe, October 1996.) The emergence of the 1997/98 El Niño just six months later added considerable momentum to the planning already underway, and RCOFs were held in nine regions around the world over this period.

The Forums brought together climate forecasters and forecast users to develop a consensus forecast product from amongst multiple individual predictions, and to discuss methods of dissemination and application of the information. Training has been an important component throughout the Forums. The Forums have since taken root and have become regular milestones in the calendars of many regions (figure 1).

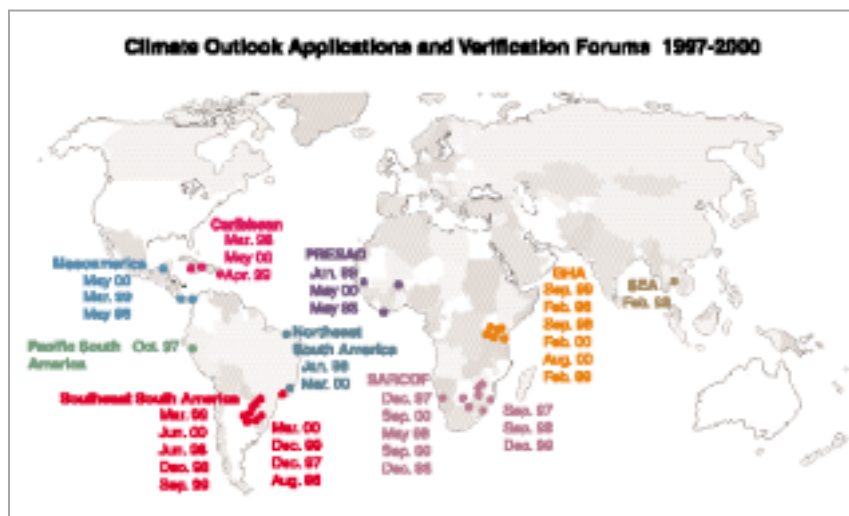


Figure 1

Regional Climate Outlook Forums have played a significant role in capacity building in many parts of the globe. The Forums have also helped develop links and mutual understanding between meteorologists and end users of seasonal forecasts and have stimulated the development of national empirical seasonal prediction capabilities in numerous countries, particularly, but not uniquely, within Africa. Further, the Forums have stimulated interest in and created recognition of the impacts of interannual

climate variability and have assisted in developing activities that both mitigate such impacts and help adapt to climate variability. By many measures the Forums have proved invaluable as a catalyst to developing user-oriented climate services.

### PROCESS USED FOR THE REVIEW

By 2000, the time had arrived to review the entire process of the Forums, and to document and evaluate the wide range of approaches being taken in the different regions. Matters for study included how the current prediction methods employed were keeping up with advances in the science of prediction, how the needs of users were being incorporated into forum activities, the effectiveness of dissemination methods, how training needs were being addressed and how the costs of the Forums could be sustained over the long-term. The wide range of experiences across the different regions offered great potential for inter-regional learning.

The review was organized to consider two major questions:

- To what extent, and how, might the outputs of the Forums be improved for the benefit of end users of the information; and
- How might the process of developing and delivering forecast information and training be made sustainable?

An ad hoc Review Organizing Committee was formed of representatives of the following organizations: the World Meteorological Organization (WMO, Mike Harrison, Chair), the U.S. National Oceanic and Atmospheric Administration (NOAA, Candyce Clark), the International Research Institute for Climate Prediction (IRI, Reid Basher), the World Bank (Maxx Dilley) and the South African Weather Bureau (SAWB, Eugene Poolman). The review was implemented through a structured consultation with RCOF stakeholders, in order to elicit the experiences of the hundreds of organizations that had been involved with the RCOFs and to thereby provide a comprehensive, peer-reviewed basis for conclusions. It was intended to systematically identify the frontiers of accomplishments to date, to capitalize on participant experiences elsewhere, and to address areas where further progress in the management of climate variability could be achieved. Proposals were not limited to maintaining the current Forum process; innovative and radical solutions were sought throughout.

The review was developed in two parts; an international workshop in Pretoria hosted by the South African Weather Bureau, and a consultative Preparatory Report assembled in advance of the workshop. To develop the Preparatory Report, the Review Organizing Committee engaged 30 authors, both climatologists and forecast users, who had been central to the formation of each series of regional RCOFs. The authors were asked to consult widely among the participating organizations in their regions and to contribute chapters documenting both climatological and applications aspects of their region's RCOF process. The Committee formulated an initial set of core issues and discussed these with the regional groups of authors to further refine and shape the issues covered in each regional chapter. The Preparatory Report also contained three cross-cutting thematic chapters on the technical aspects of climate forecasting, on the interface with users, and on issues of forum sustainability. All chapters were sent to a wide audience of specialists for comments and revisions. The entire Preparatory Report is included in the full report of the review, which has been published and is also available on the worldwide web (see inside back cover for website details.)



The second part of the review, the Pretoria Workshop, involved the participation of the authors of the Preparatory Report, representing the regions in which Forums or similar activities have been held, together with selected invited experts to cover the main thematic areas — forecasting, the media, users and applications, and sponsorship. There were approximately 60 participants.

The Workshop was designed to frame the issues that had emerged from the Preparatory Report and to distill them down into a set of core issues that reflected the most commonly experienced benefits and problems as well as the most important challenges and opportunities. In addition the Workshop was requested to examine options for future



development and sustainability of the forums. The first part of the week was devoted to plenary presentations and synthesis of the Preparatory Report from the various perspectives. Working groups were then formed to examine common themes and identify problems and alternative solutions. By the end of the week, nine writing teams had each produced a forward-looking report capturing lessons learned and identifying next steps. A precis of the nine reports is given later in this summary report. The nine reports group into four main topic areas.

- **Regional Perspectives**, for (i) *Africa*, (ii) *Latin America*, (iii) *the Caribbean, Pacific Islands and Southeast Asia*.
- **Delivery of Products and Services**, covering (i) infrastructure requirements for a *Climate Forecasting and Information System*, (ii) *Networking and Communications*, and (iii) *Media Strategy*.
- **Technical Issues**, covering (i) *Climate Forecasting and Applications Research and Development* and (ii) *Verification of Forecasts*.
- **Capacity Building** for the three topic areas above.

The Review Organizing Committee subsequently assembled two reports: a full report containing the complete set of outputs of the review — the Preparatory Reports, the full reports of the writing teams, together with supplementary information — and the present summary report intended for wider distribution.

## THE SCIENTIFIC BASIS OF SEASONAL CLIMATE FORECASTING

Predictability of the climate from season-to-season and year-to-year primarily arises from the interaction of the ocean and the atmosphere. The best-known example is the El Niño Southern Oscillation (ENSO) phenomenon. ENSO involves the quasi-periodic warming and cooling of sea-surface temperatures (SSTs) in the eastern Pacific Ocean (figure 2). The combination of the slowly changing oceans and interactions with the atmosphere provides a degree of predictability for seasonal climate in many regions of the world.

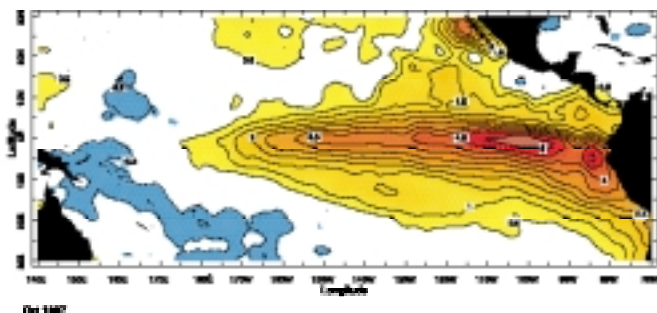


Figure 2  
El Niño SST anomalies

ENSO and other sea-surface temperature anomalies are known to influence global climate, altering rainfall and other climate variables throughout much of the tropics and sub-tropics and, in a few locations, in mid-latitudes (figure 3). Seasonal climate prediction is based on the

expectation of effects of these influences in the coming season. Seasonal forecasters ask the following two basic questions: what will the sea-surface temperature anomalies be in the coming season, and how will they impact global climate?

Current seasonal forecasting methods involve the use of dynamical computer models such as Global Coupled Ocean-Atmosphere General Circulation Models (GCMs) and higher-resolution regional models as well as statistical methods based on historical data. These techniques

provide ways of specifying the behavior of the oceans and atmosphere, and the interactions between them, and of using information about the interactions to predict the probable behavior of specific climate variables, such as temperature or precipitation, over certain regions and time periods.

GCMs are complex and are developed and run only at major centers. Regional models are also complex but are starting to be used outside the major centers to address regional needs. Statistical models and relationships are more easily constructed and are in widespread use. These are typically built up from local climate data and sea-surface temperature information for the Pacific or other major oceans. There is a tradeoff between the GCM approach, which endeavors to model the physics of the climate's actual seasonal evolution but which requires large resources, and statistical approaches, which are simple and inexpensive but which can represent only a single type of climatic behavior evident in the historical data.

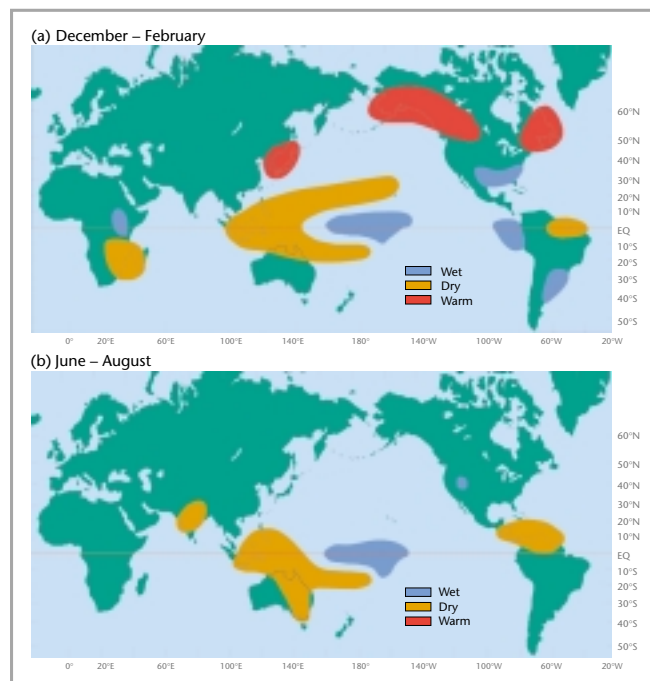
It is important to recognize that seasonal climate predictability is not universal – the nature of the climate system only allows for predictability in certain circumstances. A sizeable fraction of the seasonal variation of the climate is inherently unpredictable. Even where predictability is known to exist, the available scientific methods may still be unable to capture fully that predictability.

Furthermore, the nature of the climate system and current scientific limitations allow forecasters to provide only probabilistic forecasts rather than the unqualified, deterministic forecasts that users usually seek. They provide information about the likely characteristics of the seasonal climate, but they cannot indicate the exact timing, spatial distribution and eventual averages or totals of specific variables. The non-universal and probabilistic characteristics of the seasonal climate forecasts are critical to their use and are key factors leading to the need for Regional Climate Outlook Forums.

### ORGANIZATION OF THE RCOFS

RCOFs were conceived as a means of bringing together the results of the various means of generating forecasts and reviewing them with the best of national, regional and international expertise. Furthermore, user involvement has been an explicit component of the Forums from the beginning, for discussion of forecast results and feedback on their usefulness.

The approaches taken in the different regions vary, but there are many commonalities. Forums usually occupy several days, and typically involve national presentations, assessment of climate status and outlooks, consensus forecast building, and forecast drafting. The scope of each event depends on the number of countries and participants involved, and the amount of associated activity such as training and user workshops.



*Figure 3*  
Typical El Niño impacts

The first Forums in specific regions were led by climate scientists searching for more informed regionally-consistent forecasts, with a selection of social scientists and user representatives to provide input on the impacts of past variability and on how forecast information might be applied in their areas of interest. Since then, and with this review, there has continued to be an emphasis on improving the forecasts from the users' point of view.

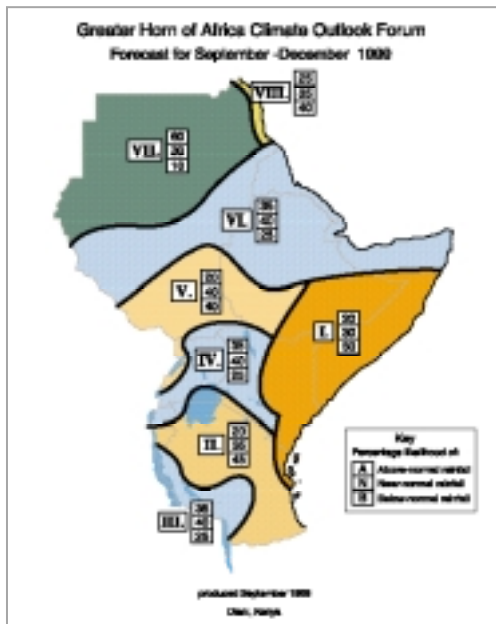


Figure 4

## OUTPUTS

Seasonal outlooks are generated by combining dynamical and statistical climate model predictions, as interpreted by experts, to arrive at a consensus forecast. Participants in the forecast consensus process include representatives from National Meteorological and Hydrological Services (NMHSs), regional centers and a variety of national, regional and international research institutes. The consensus forecasts are typically presented in map form, which emphasizes the probabilistic nature of the forecast (figure 4).

Each map presents the forecast in terms of the probabilities that the rainfall will be among (i) the lowest third of all previous years' rainfall for this zone and season, (ii) the middle third, and (iii) the highest third. These are usually given as percentage probabilities in a row or stack of three numbers. The map is generally accompanied by a legend and a text explanation that gives details of how the outlook was generated and a discussion of which climatic factors were considered.

## USERS

RCOFs arose from recognition of the needs of users for better seasonal climate forecast information. At the outset of the Forum process, however, it was not clear who the users were, or should be, or what their needs were, or how to engage actual and potential users in the Forums. It is now recognized that forecast users range from individual end-users to intermediaries acting of behalf of large groups of end users. User participants at Forums include people from sectoral government ministries, non-governmental organizations, the media, sectoral or application-specific research organizations, climate research centers, donors and the private sector. Media conferences are often held at the conclusion of the Forums.

Following the forums held during the 1997-98 El Niño event, more direct involvement of users in the entire process was encouraged. Specific measures have included user workshops and training exercises, assisted joint activities by climate scientists and users, consideration of pilot research projects, and in some cases the active involvement of users in the organization of the Forum.

It is now common practice for climate forecasters and users to conduct national cooperative information dissemination activities immediately after returning from the Forum. In some cases this has been achieved successfully by means of one-day national seminars modeled on the RCOF format.



The findings of the RCOF review are summarized below. An overall assessment of the accomplishments to date is followed by more detailed diagnostic assessments from the Pretoria Workshop of achievements, opportunities, constraints and requirements for improving management of climate variability along both regional and thematic lines. A final summary of the main findings and issues that were highlighted during the review is also provided.

### BENEFITS OF THE FORUMS

While the consensus seasonal climate forecast is the Forums' principal output, many other benefits have been frequently cited. The Forums provide a hub for activation and coordination of regional climate forecasting and applications activities into informal networks. The Forums provide a unique opportunity for all players concerned with the production and use of climate information in a region to meet, share concerns and information, and forge an informal network to address common problems. With the Forums as their seasonal milestones, these networks tie together activities such as methods development, data sharing, training and capacity development within the region. The Forums and networks also provide focal points for donors and donor coordination. The Forums often identify and have launched separately funded pilot projects to research and develop specific local applications of forecasts.

The Forums provide a venue for crucial face-to-face interaction among several sets of actors. Interaction between national-level operational meteorologists and climate researchers improves forecasting capacities and enables the comparison of data and methods to smooth out discrepancies over interpretation of rainfall probabilities spanning national boundaries. The synthesis of results, views and perspectives gives rise to one of the Forums greatest contributions: an authoritative consensus on the likely overall quality of the rainfall season and the factors governing it. This consensus mitigates problems of potentially conflicting forecasts from multiple sources and gives national-level forecasters strong technical backing for national-level downscaling and interpretation.

Another Forum contribution has been systematic producer/user dialogue. This dialogue has been instrumental in educating participating sectoral and application-specific climate information users on the scientific basis for anticipating seasonal climate, and on the meaning and limitations of the forecasts, and has provided opportunities to think about and discuss how to use this new type of information to improve climate variability management. Equally important, users have had the opportunity to state their needs and priorities to forecasters and climate researchers. While some requirements go beyond



what is currently scientifically possible, some requests – for more frequent updates, post-season verification and other seasonal characteristics besides total average rainfall – are within current capabilities to address. These requirements are already influencing the types of products that are being developed, although more needs to be done.

The interaction and dialogue at Forums has resulted in more educated and informed participants on all sides. Thus, the forums are valued for many contributions – regular production of authoritative consensus on likely seasonal rainfall, forecaster/user dialogue, greater capacity to produce and use forecasts, and regional coordination of national-level and international activities and actors.

## **REGIONAL ISSUES**

The Pretoria workshop began its review with a synthesis of the Preparatory Report and identification of core issues and problems that had been identified by its authors. Through a series of iterative breakout and plenary sessions during the weeklong workshop, nine priority areas were identified to be addressed by working groups. The working groups analyzed each priority area and made recommendations for follow-up action. The full reports drafted during the week from each working group are found in the complete report (see inside back cover for details). Regional issues were examined by three working groups covering (i) Africa, (ii) Latin America, and (iii) the Caribbean, Pacific and Southeast Asia. Regional themes are highlighted in box 1 (p. 16).

### *Africa Working Group Report*

Consensus seasonal outlooks are prepared ahead of each rainfall season by climate forecasters and user groups at the three RCOFs in Southern Africa, Western Africa and the Greater Horn of Africa. Key regional centers include the Drought Monitoring Centres in Nairobi and Harare and AGRHYMET and the African Centre of Meteorological Applications for Development in Niamey. Recent capacity building activities at National Meteorological and Hydrological Services (NMHSs) enabled them to produce national seasonal outlooks that formed part of the input at the Forums. The internationally sponsored Forums are the primary process through which NMHSs in most countries generate the seasonal outlooks.

Among the gaps identified in the process to date, a key area is the design and delivery of forecast products that satisfy the needs of end-users. Achieving this will require further efforts to demonstrate benefits of the Forum products. Other challenges include the sustainability of the Forums, the continued need to improve the scientific underpinnings of the forecasts in Africa, capacity building, and sources of sustained support. There is an overall need in the region for clear articulation of a vision, strategic planning, and continued effective leadership at all levels.

Consequently a five-year plan has been developed for enhancing the Forum process in five areas:

- Reaching users
- Improving the forecasting process
- Building the capacity of participating meteorologists and intermediaries
- Strengthening collaboration, communication and networking
- Formation of management teams at the national and international levels to coordinate human, organizational and financial resources

A series of measures is given for each of these, designed to assist with identifying and reaching specific end-user constituencies and appropriate intermediaries with relevant information, promoting capacity development and forecast dissemination at the national level, and creating a sustainable institutional framework for supporting and continuing the forecasting and applications process.

#### *Latin America Working Group Report*

The RCOFs have had beneficial impacts for Latin America's economy and society. By providing climate outlook information to governments and the private sector, the Forums have helped to reduce losses normally associated with the climate impacts linked to sea-surface temperature variations such as El Niño in the Pacific Ocean and those in the Atlantic. Furthermore, the Forums have increased public awareness about climate forecasting and its role in decision making, as well as promoting the interaction of researchers and institutions at national, regional, and international levels.

Opportunities exist for improving the Forum process in Latin America, for increasing the benefits and for achieving sustainability. In this context the Forums are seen as a process in which the climate outlook is but one element. The entire process encompasses a wide range of activities, from the formation of regional groups to produce regional seasonal climate forecasts, to data base management and exchange, research on climate variability, prediction, and applications, as well as capacity building, among other elements.

The working group identified the following landmarks to strengthen the Forum process in Latin America:

- Establishment of operational regional coordination
- Establishment of a forecasting and applications research agenda
- Achievement of a critical mass of expertise on climate prediction and applications
- Establishment of improved mechanisms for serving user needs and feedback
- Attainment of sufficient funds to ensure sustainability of the Forum process

Additional resources will be required to support these landmarks over a five-year period.

#### *Caribbean, Pacific Islands, and Southeast Asia Working Group Report*

Previous approaches to developing seasonal predictions in these three regions vary, partly because of their very different circumstances.



Some capacity already exists to provide climate forecast information at the regional level through existing climate forecast centers and networks, although these should be enhanced and strengthened. Forecasting capacity at the national level is unevenly distributed between countries and needs to be enhanced through training, development of statistical models for rainfall and other climate factors, and, in some areas, additional computer and information technology.

In all three regions, capacity is needed to develop and enhance the application of climate information. Currently, climate information users include disaster managers, hydrologists and water managers, and, in the case of Southeast Asia, environment ministries. Pilot projects and workshops involving climate information users are needed to develop better understanding of user needs and to develop an understanding of the value of climate forecasts and information in agriculture, water resource management, health and other sectors.

In all three regions, support is needed from policy makers to insure the development and institutionalization of regional climate information centers and networks, together with the development of applications and capacity development at the national level.

## **BOX 1** **Regional Issues Summary**

- 1. Continue capacity building, ensuring maintenance of expertise at cutting edge. Hold national training workshops for all involved, from meteorologists through the chain to end users.**
- 2. Develop a research and implementation agenda appropriate for all regions, including issues such as downscaling for specific locations, sectors and applications.**
- 3. Conduct end-to-end demonstration projects in all areas and applications sectors.**
- 4. Prepare training materials.**
- 5. Select and train trainers, including intermediaries.**
- 6. Create user demand and awareness, including holding Workshops for policy makers.**
- 7. In Africa, plan the transition of the Forum process to the NMHSs, with mandating of regional centers during the transfer process.**
- 8. Improve access to GCMs and statistical model predictions at regional and national levels.**
- 9. Explore virtual forums, video conferencing, and any other options for using new technologies etc., as possible methods for reducing costs.**
- 10. In Africa, establish regional management teams to prepare a strategy on development of the entire process, including funding.**
- 11. In the Caribbean, Pacific and Southeast Asia, enhance or establish regional climate and information centers. Specifically in Southeast Asia, develop an integrated and comprehensive Southeast Asian Climate Forecast Information System.**

## DELIVERY OF PRODUCTS AND SERVICES

Issues related to identification of clients and improved delivery of products and services are discussed below. Working groups included (i) infrastructure requirements for a climate forecasting and information system, (ii) networking and communications, and (iii) media strategy. Main points covered in this area are summarized in box 2 (p.20).

### *Climate Forecasting and Information System Working Group Report*

In order to provide maximum societal benefit, the available scientific understanding about climate, climate variability and extreme climate events needs to be operationalized into an integrated climate information system (CIS). An effective CIS would be largely based on existing organizational mechanisms and would have three distinct but inter-related components:

- A forecasting system
- A continuous monitoring system
- A knowledge base of the climatology of different regions

Although the potential value of climate forecasts is enormous, their application remains minimal. There are repeated requests from users for improved forecast quality and for more detailed forecast information, such as onset and cessation of the rainfall season, and dry spells within the season. Greater attention needs to be given to combining, interpreting, disseminating, and tailoring forecasts to promote the beneficial application of the forecasts. It is therefore recommended that research into developing and improving forecast products that are of more direct interest to the user community be supported.



Climate forecasting services need to be supported by monitoring activities. Monitoring is required for forecast verification, and provides necessary data for updating forecasts as the season progresses.

Ultimate responsibility for a CIS lies at the national level, but regional activities are a necessary and cost-effective option for supporting national efforts, especially where resources are limited. Attention needs to be given to strengthen the communication and collaboration between existing national, regional and global centers, enhancing their capabilities where necessary. Specific areas that need to be addressed include:

- Capacity building
- Improved climate databases
- Climate monitoring and evaluation methods
- Forecast evaluation methods
- Computing facilities, increased coordination
- Demonstration of the use and value of the information

National and regional centers need to be strengthened over the next five to ten years. It is also recommended that the national and regional centers should explore ways of mobilizing resources beyond their traditional sources of financing, perhaps from commercial enterprises and local government.

## *Networking and Communications Working Group Report*

RCOFs have enhanced the communication between and among scientific groups and policy makers, media representatives, and some intermediaries and end users. The success that has been achieved through the Forums in improving communication, networking, and public awareness, is one of the key functions that Forum participants would like to continue and capitalize upon in the future.

Priorities for sustaining and augmenting communication and networking capabilities are strongly tied to the importance or urgency of the forecast issued by a forum. Clearly all forecasts are not communicated and received with the same sense of urgency. The working group identified two scenarios, which the group defined as 'high urgency' and 'low urgency' scenarios. These two scenarios have different characteristics and require different networking and communications strategies. The main priority in a high urgency scenario is to issue a clear and timely forecast. Communications and networking activities should focus on communicating the forecast message (including probabilities and uncertainties) to the media, policy makers, and other important intermediaries. In high urgency situations it is clear that responsibility and accountability ultimately reside at the national level. Priorities in low urgency scenarios should focus more on long-term issues. The release of a forecast in a low urgency scenario is not likely to attract media and policy maker attention. However, regions should utilize these low urgency years to attack long term networking and communications issues, such as:

- Creating climate forecast units and working groups in NMHSs including meteorologists, intermediaries and end-users
- Creating focal points in the NMHSs and linking them to regional centers to facilitate exchange of information
- Developing a forum list server in each region to facilitate communication between climate forecast producers and intermediaries/users
- Establishing regional scientific networks for both climate and applications
- Improving climate information by reviewing/updating data sources, available climate models, and monitoring capacities
- Establishing research and development methods for applications
- Designing regional research programs/proposals (e.g. pilot projects, user surveys, etc.)
- Identifying the needs and context of key users and intermediaries through focused studies
- Undertaking in-depth economic studies to quantify forecast value as applied to funding justification and loan feasibility
- Organizing training courses and education activities for climate scientists, NMHSs, and users/intermediaries
- Organizing training courses for communicators to act as effective intermediaries in the forum process

In some regions the above actions would be best undertaken within the context of a Forum, while other regions may choose to focus such functions in separate but related activities such as workshops, training courses, symposia, etc. Whether or not these functions should be linked to forecasting activities (i.e. 'forums') depends upon the needs of the particular region.

## Media Strategy Working Group Report

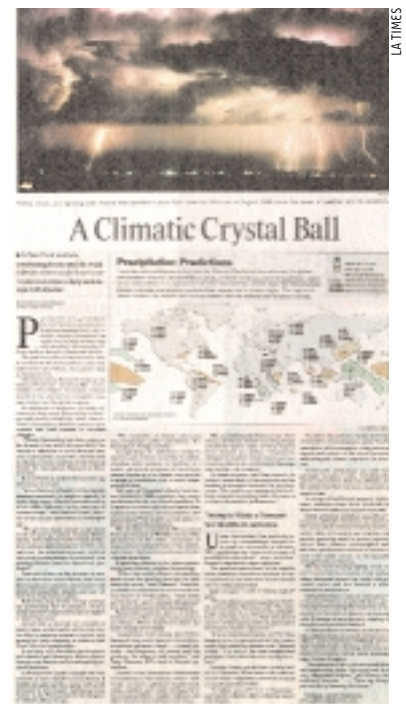
In the past the RCOFs have met with limited success in communicating the regional forecast and the RCOF story itself to the media. New, aggressive, pro-active strategies are required to improve forecast dissemination through the media. The working group made a series of recommendations for focusing a media strategy that should be discussed by NMHS directors in each Forum region and agreed upon prior to the Forum.

The strategy consists of two parts – immediate and long-term. Immediate dissemination focuses on items of current news value where the priority is to communicate the forecast product quickly. Long-term dissemination means building public awareness and on-going public education.

For the immediate strategy, it is proposed that the organizing committee of each forum coordinate with the directors of the region's NMHSs to review the final press release before its issuance with an embargo. The final product would be released simultaneously nationally by the NMHSs, and internationally by WMO through international broadcasting networks along with supporting materials such as previous press releases, TV footage, and camera-ready graphics and animations, and expert contacts for media follow-ups.

For the long-term strategy, the RCOF should develop relations with the media and other partner organizations to build awareness and educate the public. This strategy must be deliberated and agreed upon by NMHSs and other appropriate regional entities in advance of the generation of forecast products. Developing long-term public awareness through better overall use of the media involves:

- Identifying potential win-win opportunities with other partners in related fields such as food security, environmental protection, family planning, etc. by sharing media strategies (e.g. creating news media events such as the role of climate forecasting in preparing and reducing the effects of natural disasters)
- Incorporation of media components into existing pilot projects and encouraging media-focused pilot projects such as a study on "Who Are the End-Users?"
- Development of a "communication culture" within the national and regional scientific communities to stimulate open exchanges of information, ongoing public awareness, and a long-term relationship with the media (not just in an emergency mode), and including systematically improving the media communications skills of key spokespeople
- Training for print and electronic media journalists to accurately and effectively communicate climate information
- Use of WMO guidelines on training workshops for regional or national entities
- Exploration of the full-range of means available to communicate to the community, such as the TV soap operas, pop songs and folk music used to communicate important public health messages.



**BOX 2**  
**Delivery of**  
**Products and Services**  
**Summary**

1. **Recent climate anomalies are an important factor in affecting current variability, and therefore the monitoring capabilities and climatological databases of national and regional climate centers should be strengthened. Computing and related software facilities need to be improved consistent with the requirement.**
2. **Discriminate periods into those in which major climate events are taking place from the rest, and emphasize long-term development activities during the latter.**
3. **Establish regional networks of researchers for both climate and applications working within, at least in part, regional research programs.**
4. **Establish research and development methods for applications, enabling, amongst other things, the undertaking of in-depth economic studies to quantify forecast value.**
5. **Develop a new pro-active media strategy on International, Regional and National levels. This strategy, including immediate and long-term components, can include the networking capabilities of the WMO Information and Public Affairs Office.**
6. **Ensure the participation of a media expert at each Forum to assist Forum managers in promoting the meeting and its outcomes and for developing news items. Provide training for these experts.**
7. **Develop a “communication culture” within scientific communities.**

### **TECHNICAL ISSUES**

In addition to the regional issues and those related to delivery of products and services identified above, the RCOFs continue to require additional scientific and technical inputs. Working groups in this area covered: (i) climate forecasting and applications research and development, and (ii) verification of forecast information. Issues in these areas are summarized in box 3 (p. 22).

#### *Climate Forecasting and Applications Research and Development Working Group Report*

The forums have been an excellent means for cross-fertilization of ideas between users, local experts and the broader scientific community, much to the benefit of the forecasters. However, there are large gaps between the present use of climate outlooks, their uptake, and the potential maximum benefits. There is a need to identify more precisely the individual information needs for each application.

Currently, there is no well-defined methodology for integrating the various sources of climate information into the consensus forecasts. Likewise, there has been no clear methodology to identify user applications that can benefit most from the forecasts. While success stories exist, there have been no systematic surveys of potential areas of applications, and no formal channels for sharing results and lessons learned. In addition, there exist many gaps in the producer-to-end user dissemination chain.



The ultimate goal of the forums is to promote the development of end-to-end processes that ensure that forecasts reach end users in a format appropriate for optimal decision-making. To achieve this goal, the following priorities have been identified:

- Shape and implement a research agenda for applications, informed by user needs
- Shape and implement a research agenda for forecasts, informed by scientific developments, covering applications, methodology, downscaling, and verification
- Identify and address gaps that constrain the wider use of climate information

This will require a much more proactive and systematic approach. Concentrated effort on forecast and applications research and development is essential. Moreover, the results of such research and development will need to be well demonstrated and disseminated to ensure full uptake and the realization of benefits.

#### *Verification of Forecast Information Working Group Report*

The term “verification” means the systematic evaluation of forecasts against actual outcomes. The verification process needs to be scientifically well based in order to demonstrate the scientific credibility of the Forum process and to allow scientists to evaluate technical aspects of forecast performance. Verification information is important to convincing actual and potential stakeholders, including donors, that the summary outlook products from the Forums have value for the end user.

There is a technical aspect to the verification process and a data requirement. Some regions have begun to apply verification methods, including Africa and southeastern South America. These limited verifications have been well received and judged useful. However, generally, they have not been systematically produced on a regular basis, are not widely documented, and are not based on sufficient stations for high confidence in their results.

A good technical verification (i.e. satisfying the forecast scientist) would not be enough on its own. Users and other stakeholders need to see at differing levels of detail how the season compared to the forecast for those factors of interest to them. The associated issues of presentation to reach outside the meteorological community are currently not receiving sufficient attention. Finally, there is a need to evaluate the prediction information in terms of its contribution to decision-making and value added from climate information. There is little information available on this topic. While there are a small number of case study examples, the information is currently not widely available. More systematic research and documentation of the contribution of climate information to decision-making is vital to sustain investment in climate forecasting and applications institutions, networks and systems.



### BOX 3 Technical issues Summary

1. **Shape and implement a research agenda for applications, informed by user needs.**
2. **Shape and implement a research agenda for forecasts, informed by scientific developments.**
3. **Identify and address gaps that constrain the wider use of climate information.**
4. **Examine the extent to which current Forum predictions can be downscaled to smaller local regions.**
5. **Develop hypothetical Forum products for last 30 years by statistically combining predictions created by current models; examine results for quality and value.**
6. **Examine on a regular basis whether or not the progress of a season is consistent with the Forum product.**
7. **Develop a summary of the performance of all Forums to date using a consistent methodology.**
8. **Undertake further analyses of the value obtained through use of Forum products.**

### CAPACITY BUILDING

Capacity building covers all three of the areas covered above — regional and technical issues and delivery of products and services. Capacity building issues and needs were reviewed by a working group and are summarized in box 4 (p. 23).

#### *Capacity Building Working Group Report*

Sustainability will occur more readily if the primary entry points are at the national level. The key elements are suitable trained personnel, suitable equipment to carry out the work, and an efficient communications system, all operating within a policy environment supportive of the tasks in hand. Investment is the key to future success for both information producers and users. Investment through capacity building will assist in achieving improved content and uptake of forecast products.

While the outputs of the seasonal forecasting end-to-end system are seen as inherently valuable, user uptake of the forecast information has been limited and their full potential value has yet to be realized. As most end users and their intermediaries are at the sub-national and national levels, the greatest return on investment will be from strengthening the interface between the national producers and the intermediaries who help to translate the forecast products (ideally both sector-specific and into vernacular languages).

It should be noted that the pre-forum training that has occurred over the last three years evolved as a default to service an immediate need and, as such, should be continued in the short term. Regional training,

in whatever framework, is desirable because it provides economies of scale. However, other options such as distance training, in-country training or single-nation training within a regional facility should also be explored as possible better ways of achieving the same goal.

A five-to ten-year plan, including specific measures and institutions has been prepared. Capacity-building areas and goals include:

#### **Forecast Producer – Human Resource Capacity Building**

- Improvement of human resource capacity in forecast product producers

#### **Forecast Producer – Institutional Capacity Building**

- Enhancement of national computing and communication capacities, including all elements of database management
- Development of institutional capabilities in forecast producers
- Improvement of the national observing network for the creation, monitoring and verification of seasonal predictions
- Improvement of the oceanic observing network for improved seasonal predictions

#### **Users – Human Resource Capacity Building**

- Systematic identification of users and user-groups, and their needs, to occur predominantly at the national level
- Building a cadre of sectoral-specialist intermediaries for improved, sector-specific product translation and dissemination
- Sensitizing of media to act as a responsible partner in the process of product dissemination

#### **Users – Institutional Capacity Building**

- Improvement of institutional capabilities for users

1. **Supplement Forum-type training with a range of on-going professional development courses and activities, while ensuring institutional commitment to the training and deployment of personnel.**
2. **Re-examine national needs for computing technology.**
3. **Develop a cadre of sector-specific intermediaries for improved, sector-specific product translation and dissemination.**
4. **Develop sector-specific databases, research capabilities and dissemination through specific products based on translated predictions.**

#### **BOX 4 Capacity Building Summary**

### **SUMMARY OF IDENTIFIED NEEDS**

The specific recommendations from the nine working groups have been consolidated into four key areas where the RCOFs need to be strengthened: a) Regional issues, including sustainability, b) Delivery of products and services, c) Technical issues, and d) Capacity building. Several items of particular importance are worth highlighting.

There was recognition of the need to **differentiate between the roles of end users and intermediaries**. Intermediaries include agricultural extension agencies, rural non-governmental organizations, government departments, consulting engineers, enterprise managers, and sector organizations. There is a need to **systematically identify and involve the key specialized intermediaries** who can define the requirements of critical applications and communicate tailored information specific to those applications to end-users. End users on the other hand are people or institutions at any level that can take decisions on the basis of the information provided. It was recognized that RCOFs cannot effectively engage the multitude of potential end users, but can reach them through intermediaries. These intermediaries can become part of the process of producing sectoral guidance as an integral part of the RCOF process. They can also assist in **stimulating demand for forecast information**, and in articulating the specifics of the **required more user-tailored products**.

It was also recognized as important to **make full and proactive use of the media** to inform and advise the general public about the likely quality of upcoming seasons, particularly severe events. The review produced recommendations urging that relations with the media be cultivated and media channels established during non-extreme years so that the groundwork is laid for effective communication of climate information in years when the climate impacts are likely to be greatest.

Another important requirement of the RCOF process is **verification, not only of the forecasts but also of their uses and impacts, both positive and negative**. Verification is critical not only to foster transparency and to build confidence but also to provide information for evaluating the economic benefits of the forecasts in order to promote sustainability of the RCOF process.

Sustainability is a key concern over the longer term, and as part of the next phase of RCOF development it will be necessary to **put the RCOFs on the path to sustainability**. This includes cutting costs, generating greater benefits, diversifying funding sources and documenting the economic impacts of forecasts to guide future investment. Another need that was identified is for **pilot projects** to develop and test new applications and techniques. In the context of a formalized climate forecasting and applications research and development agenda, lessons learned from these pilots can contribute to the further evolution of the RCOFs and can be transferred from one region to the other and from regional to national levels.

Therefore, there is a need to **build regional capacity so that the regions can in turn build capacity at the national level**. The national level was clearly identified as the one at which many, if not most, meaningful end user decisions are made. However, strengthened regional capabilities were identified as key for promoting national level forecasting and applications. Strengthening regional capacity entails improving data sharing and climate monitoring to build up the information and knowledge base on the climate and its impacts in each region.

Lastly, there is need to **enlarge and mobilize the stakeholder base**, and to engage them in the design and implementation of global, regional and national **agendas for the development of sustainable RCOF processes**.



The Review has identified a comprehensive and rich set of follow-up actions along both thematic and regional lines. The Review Organizing Committee believes that the implementation of these actions would significantly enhance the application of climate information in regions affected by seasonal to inter-annual climate variability, reduce vulnerability to climate fluctuations, and build capacity for managing regional climate change.

On the second day of discussion at the review workshop, it was noted that future progress in the development and use of seasonal climate forecasts would be greatly enhanced by *“more systematic organization of the roles and responsibilities of forum partners including users, researchers, and operational organizations”* and by the *“partnerships ... needed at all levels of the process.”*

To achieve such organization and partnerships, it will be necessary to widen the scope of the effort to include the many organizations and programs already involved in the process of managing climate variability and change. By joining forces, a more effective and well-orchestrated attack on the problems might be developed. Many of these organizations were not participants in the present review. The following list of potential partners known to the Review Organizing Committee illustrates the main types of organizations and programs that might be involved:

- United Nations entities concerned with disaster reduction and sustainable development or specialized sectoral interests, such as WMO, UNDP, UNEP, UNSO, ISDR, UNESCO
- International science programs and organizations, such as CLIVAR, IGBP, IHDP, CLIMAG, CLIPS, PROMISE, the CGIAR system, the IRI, and supporting universities and research institutes
- International donors and multi-lateral banks, such as the World Bank, IADB, ADB, and the many national aid agencies
- Institutions and programs concerned with adaptation to climate change and related capacity building, such as START
- Regional development organizations, such as ADPC, IAI, APN, ENRICH, ACMAD
- National governments
- Non-governmental organizations
- Sectorial bodies and enterprises

A common strand throughout the review was the need for systematic vertical and horizontal integration. Vertically, there is a need to clarify and reinforce the current three-tiered support structure in which international/global efforts are mobilized to strengthen and build capacity at the regional level, while the regional level works to strengthen and build capacity at the national level. Horizontally, there is a need to focus on and build capacity in key areas, including







the development of improved and user-tailored forecast products in partnership with appropriate intermediaries, broader outreach through the media, verification of forecast products and evaluation of forecast costs and benefits. To achieve such integration, sustained and focused partnerships are needed both vertically and horizontally, and at all levels. Such partnerships may work through existing institutions and their programs or they may require new alliances in order to address new needs.

The Review Organizing Committee and participants therefore strongly recommend that the needs, opportunities and recommendations of the review be pursued in a systematic, sustained and coordinated manner. It is clear that there is a need for continued effort to define problems, overcome obstacles and realize unmet potential in the areas identified during the review. Over the next two years, effort should focus on developing the necessary organizational and technical capacities, for example through working groups, networks and other mechanisms, and on explicitly developing a path to sustainability for resourcing Forum processes.

The Review Organizing Committee proposes that a broadly based international consultation process be undertaken among stakeholders and other complementary initiatives, in order to integrate priorities and clarify roles, to mobilize human and financial resources, and to develop the necessary global alliance to address the larger goal of reducing vulnerability to climate variability and change. A new international committee will be needed to steer this process.

In conclusion, by means of this Summary Report, the Review Organizing Committee invites governments, policymakers, development experts, scientists and other interested parties to actively enter into the process of dialogue and program development needed to advance this most promising way forward in the management of seasonal climatic impacts.



## GLOSSARY OF ACRONYMS

ACMAD	African Centre of Meteorological Applications for Development
ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
APN	Asia-Pacific Network for Global Change Research
CGIAR	Consultative Group on International Agricultural Research
CIS	Climate Information System
CLIMAG	Climate Prediction and Agriculture Program
CLIPS	Climate Information and Prediction Service (of WMO)
CLIVAR	International Research Program of Climate Variability and Predictability
ENRICH	European Network for Research on Global Change
ENSO	El Niño – Southern Oscillation GCM General Circulation Model
IADB	Inter-American Development Bank
IAI	Inter-American Institute for Global Change Research
IGBP	International Geosphere-Biosphere Programme
IHDP	International Human Dimensions Programme on Global Environmental Change
IRI	International Research Institute for Climate Prediction
ISDR	International Strategy for Disaster Reduction
NMHS	National Meteorological and Hydrological Service
NOAA	U.S. National Oceanic and Atmospheric Administration
PROMISE	Predictability and Variability Of Monsoons and the Agricultural and Hydrological Impacts of Climate Change
RCOF	Regional Climate Outlook Forum
SAWB	South Africa Weather Bureau
SST	Sea Surface Temperature
START	Global Change System for Analysis, Research, and Training
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNSO	Office to Combat Desertification and Drought (of UNDP)
USAID	U.S. Agency for International Development
WMO	World Meteorological Organization

*“.... by means of this Summary Report, the Review Organizing Committee invites governments, policy-makers, development experts, scientists and other interested parties to actively enter into the process of dialogue and program development needed to advance this most promising way forward in the management of seasonal climatic impacts.”*

Further information may be obtained from the following organizations that coordinated the Review of Regional Climate Outlook Forums. The full report of the Review, “Preparatory Report and full Workshop Report (IRI/CW/01/1)” may be found at the websites of the IRI and some of the other organizations.

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**National Oceanic and Atmospheric Administration (NOAA)**

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1100 Wayne Avenue, Suite 1210  
Silver Spring, MD 20910 USA  
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<http://www.ogp.noaa.gov>

**South African Weather Bureau (SAWB)**

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<http://www.weathersa.co.za>

**United States Agency for International Development (USAID)**

Office of U. S. Foreign Disaster Assistance  
Ronald Reagan Building  
Washington, D.C. 20523-1000  
Phone: 202-712-4810  
Fax: 202-216-3524  
<http://www.usaid.gov>

**The World Bank**

Disaster Management Facility  
1818 H Street, N.W.  
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Fax: (202) 477-6391  
<http://www.worldbank.org>

**World Meteorological Organization (WMO)**

7 bis Avenue de la Paix  
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## PARTICIPATING ORGANIZATIONS

African Centre of Meteorological Applications for Development (ACMAD)  
Asian Disaster Preparedness Center (ADPC)  
Water Center for the Humid Tropics of Latin America and the Caribbean  
(CATHALAC)  
Regional Training Centre for Agrometeorology and Operational Hydrology  
and their Applications, Niger (AGRHYMET)  
Center for Weather Prediction and Climate Studies/National Institute of  
Space Research, Brazil (CPTEC/INPE)  
Water Resources Regional Committee, Central America (CRRH)  
Drought Monitoring Centre, Harare (DMCH)  
Drought Monitoring Centre, Nairobi (DMCN)  
European Centre for Medium-Range Weather Forecasts (ECMWF)  
Fiji Meteorological Service  
Hungarian Weather Service  
International Fertilizer Development Center (IFDC)  
Meteorological Service Singapore  
Ministry of Agriculture, Kenya  
National Centers for Environmental Prediction (NCEP)  
New South Wales Agriculture  
Radio-Télévision Nationale du Burundi  
Southern African Development Community (SADC) Food Security Programme  
Southern African Transport and Communications Commission (SATCC)  
Tufts University  
Universidad de Chile  
University of Buenos Aires  
University of Hawaii, Social Science Research Institute (SSRI)  
University of Oklahoma  
University of Oslo  
University of West Indies  
University of Wisconsin  
University of Witwatersrand

## COORDINATING AND SPONSORING ORGANIZATIONS

**IRI** International Research Institute for Climate Prediction  
**NOAA/OGP** National Oceanic and Atmospheric Administration/  
Office of Global Programs  
**SAWB** South African Weather Bureau  
**USAID** United States Agency for International Development  
**The World Bank**  
**WMO** World Meteorological Organization



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