# SADC DROUGHT MONITORING CENTRE

## SOUTHERN AFRICA REGIONAL CLIMATE OUTLOOK FORUM

## SEASONAL RAINFALL OUTLOOK FOR THE PERIOD OCTOBER 2001 TO MARCH 2002

## MANGOCHI, MALAWI
## 17 TO 21 SEPTEMBER 2001

## CONTENTS

Preface

Acknowledgements

Executive Summary

1 Statement from the Fifth Southern Africa Region Climate Outlook Forum

2 General Concepts

3 General Climatic Applications

4 Review of the 200/2001 Rainfall Season

5 Forecast Presentations

6 Lessons Learnt by the Users

7 Formulation of the 2001/2002 Consensus Outlook

8 Dissemination of Climate Forecasts

9 Pilot Projects and Strategic Plan

10 Recommendations and Conclusions

11 Closure of the Forum

Appendix A: Programme of the Forum
Appendix B: Speeches during the Opening Forum
Appendix C: List of Participants

## PREFACE

The Fifth Southern Africa Regional Climate Outlook Forum (SARCOF 5) took place at Mangochi, Malawi from 17 to 21 September 2001. The meeting was organized by the Drought Monitoring Centre, Harare (DMCH). The objective of the meeting, like other previous Fora, was to develop a consensus in the climate outlook for the 2001/2002 rainfall season in the Southern Africa Development Community (SADC) region.

These Fora have come about due to the successes achieved in skillfully predicting seasonal climate anomalies. The skills have improved over the years, because of the advances in physical modelling and understanding of the different components of the climate system, including the El Nino-Southern Oscillation (ENSO) phenomenon

The Forum brought together a wide range of climate scientists and users of seasonal weather forecasts to exchange data and information and to formulate a consensus rainfall outlook for the coming season. The principal participants to the Forum were delegations from the National Meteorological and Hydrological Services (NMHS) of the SADC region, which have the ultimate responsibility to disseminate the forecast product to their user communities.

The Forum projected the summer rainfall pattern in two parts, namely: October-November-December (OND) 2001 and January-February-March (JFM) 2002, which together constitute the rainy season over the bulk of Southern Africa.

The fifth Forum was realized through concerted efforts of many individuals and organizations. The main cooperating organizations included the DMCH and the Malawi Meteorological Services, as well as the SADC NMHSs, World Meteorological Organization (WMO), NOAA/OGP, USAID, DMCN and ACMAD.

On behalf of the DMCH, I wish to thank all the individuals and organizations for their contribution and assistance, which enabled the Forum to be successful. I hope the spirit of collaboration will extend to future Fora.

E M Dlamini
(Coordinator, SADC Drought Monitoring Centre)

## ACKNOWLEDGEMENTS

The SADC Drought Monitoring Centre wishes to extend special acknowledgements to NOAA/OGP, USAID, and the Belgian Aid for Development Cooperation (BADC) for the financial support to the Forum. The role of WMO for providing all the necessary administrative support and guidance for the Forum is acknowledged with gratitude. In particular DMCH would like to thank Mr V A Simango for his tireless support on behalf of WMO. Other institutions that warrant unreserved applause for their contribution to the success of the Forum include the Malawi Meteorological Services and SATCC.

We would like to acknowledge and tank all the individuals who presented papers and the climate scientist who provided technical support to the Forum. Sincere words of thanks go to the institutions that provided their forecast products to the Forum.

## EXECUTIVE SUMMARY

The 2001/2002 pre-season Southern Africa Regional Climate Outlook Forum (SARCOF) took place in Mangochi, Malawi from 17 to 21 September 2001. The Forum brought together scientists, the user community and policy makers from the SADC region, other parts of Africa, and from cooperating institutions in the region and overseas. The objective of the Forum was to develop a consensus climate forecast for the coming rainy season (October 2001 to March 2002) in Southern Africa. The consensus-forecast product from the Forum is expected to be downscaled and applied effectively in the planning of various activities that depend on weather and climate. The Forum also reviewed the performance of the previous rainfall season over Southern Africa and the accuracy of the forecasts from the fourth SARCOF.

The Forum agreed that: based on the anticipated neutral conditions in the Equatorial Pacific Ocean, and the prevailing near near-normal sea-surface temperature anomalies in the surrounding oceans, most of the sub-region was expected to experience a largely normal rainfall season for the period October 2001 to March 2002. However, for the period October - December 2001, over the northern sector of Tanzania there was a likelihood of below normal to normal rainfall while most of the southwestern sector of the sub-continent is expected to receive above normal rainfall.

The SARCOF meeting benefited from a four-week pre-Forum capacity building exercise for the National Meteorological and Hydrological Services (NMHSs) personnel. The training focussed on understanding of the regional and global scale climate processes and climate prediction and application to the SADC NMHSs.

The report summarizes the Fifth SARCOF process leading to the consensus rainfall forecast for the 2001/2002 rainfall season. The report also provides a summary of the recommendations arising from the Forum.

The report also highlights the small pilot projects, funded through the DMCH by its collaborating partners, who include NOAA/OGP and the World Bank.

# 1.0 THE STATEMENT

**STATEMENT FROM THE FIFTH CLIMATE OUTLOOK FORUM**

**FOR THE SOUTHERN AFRICA DEVELOPMENT COMMUNITY REGION**

**held at Mangochi, Malawi, from 17 to 21 September 2001**

**SEASONAL RAINFALL OUTLOOK FOR OCTOBER 2001 TO MARCH 2002**

## SUMMARY

*The Southern Africa Development Community (SADC) region will experience a largely normal rainfall season for the period October 2001 to March 2002. However, for the period October - December 2001, over the northern sector of Tanzania there is a likelihood of below normal to normal rainfall while most of the southwestern sector of the sub-continent is expected to receive above normal rainfall.*

*This Outlook is relevant only for seasonal time scales and relatively large areas. Local and month-to-month variations may occur. Any changes in the projected patterns of sea surface temperatures (SSTs) and other indicators over the next few weeks would affect the outlook in some areas. Updates of the outlooks therefore will be provided by the Drought Monitoring Centre, Harare (DMCH) and the National Meteorological Services (NMSs) in their respective countries.*

***The users are strongly advised to contact their National Meteorological Services (NMSs) for interpretation of this Outlook, finer details, updates and additional guidance**.*

## THE CLIMATE OUTLOOK FORUM

From 17 to 21 September 2001, the Fifth Southern African Region Climate Outlook Forum (SARCOF-5) was convened in Mangochi, Malawi by the Drought Monitoring Centre-Harare in conjunction with the Malawi Meteorological Services to formulate consensus guidance for the October 2001-March 2002 rainfall season for the SADC region. Users were active participants in the Forum and raised issues pertaining to the interpretation and dissemination of the seasonal outlook.

## METHODOLOGY

The Forum reviewed the state of the global ocean-atmosphere system and its implications for this region. Coupled global ocean-atmosphere models, physically based statistical models, and expert interpretation were used in the development of the outlook. The principal factor taken into account was the current state of the near normal sea surface temperatures (SSTs) over much of the tropical Indian eastern tropical Pacific and Atlantic Oceans. They are expected to remain largely normal during the next six months although the in the eastern tropical Pacific Ocean may slide into warmer-than-normal conditions towards the end of the period.

**The current status of seasonal forecasting methodologies allows prediction of spatial and temporal averages, and may not fully resolve all factors that influence regional, national and local climate variability.**

The experts established probability distributions to indicate the likelihood of above-normal, normal or below-normal rainfall for each zone (see Maps). Above-normal rainfall is defined as within the wettest 33.3% of recorded rainfall amounts in each zone; normal is defined as the middle 33.3% of the amounts while below-normal rainfall is the driest 33.3% of the recorded rainfall amounts.

### OCTOBER 2001 TO MARCH 2002 RAINFALL OUTLOOK

The rainfall season for the SADC region has been divided into two periods October to December and January to March for prediction purposes.

**For the October-December 2001 period, the rainfall outlook for each zone within the region is given below:**

***Zone I:*** (Northern half of the Democratic Republic of Congo (DRC) and northwestern Angola) Rainfall is expected to be in the normal to above-normal range.

*Zone II:* (Northern sector of Tanzania) There is a likelihood of below normal to normal rainfall.

*Zone III:* (Northern Mozambique, northern half of Malawi, northern and western Zambia, western and southern Tanzania, most of the southeastern half of DRC and the bulk of Angola) Likelihood of normal to above-normal rainfall.

***Zone IV:*** (Southeastern tips of DRC, southern and central Zambia, northern Zimbabwe, southern half of Malawi, and central Mozambique) The rainfall is expected to be in the normal to above-normal range.

***Zone V:*** (Southern coastal areas of Angola and coastal areas of Namibia) Likelihood of normal to below-normal rainfall.

***Zone VI:*** (Western half of South Africa, most of Botswana and most of Namibia) Likelihood of above normal to normal rainfall.

***Zone VII:*** (Lesotho, Swaziland, eastern Botswana, southern Mozambique, eastern half of South Africa, and southern Zimbabwe) Likelihood of normal to above-normal rainfall.

***Zone VIII*** (Seychelles) Above-normal to normal rainfall

***Zone IX*** (Mauritius) Likelihood of normal to below-normal rainfall.

**The following is the rainfall outlook for each zone within the region for January-March 2002 period:**

***Zone I:*** (Seychelles) Likelihood of normal rainfall

*Zone II* (Mauritius) Normal to above-normal rainfall

*Zone III:* (Northern sector of Tanzania) Above-normal rainfall

***Zone IV:*** (Northern half of DRC and northwestern Angola) Normal to above-normal rainfall

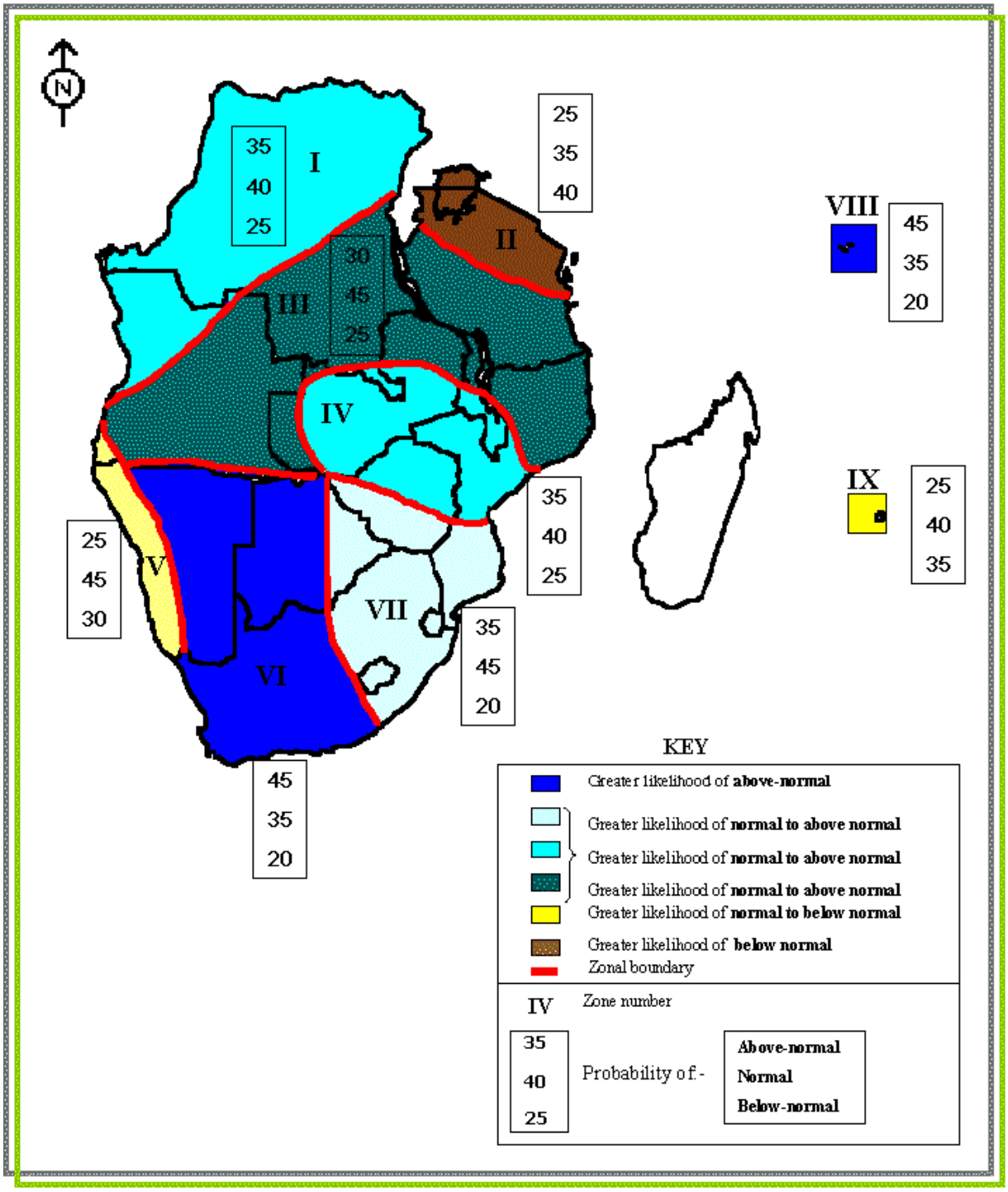
Z***one V*** (Western and southern Tanzania, northern Mozambique, northern Zambia, northern half of Malawi, southern half of DRC as well as central and eastern Angola) Likelihood of normal to above-normal rainfall

***Zone VI:*** (Western Angola, western half of Namibia and southwestern South Africa) Rainfall is expected to be in the above normal to normal range.

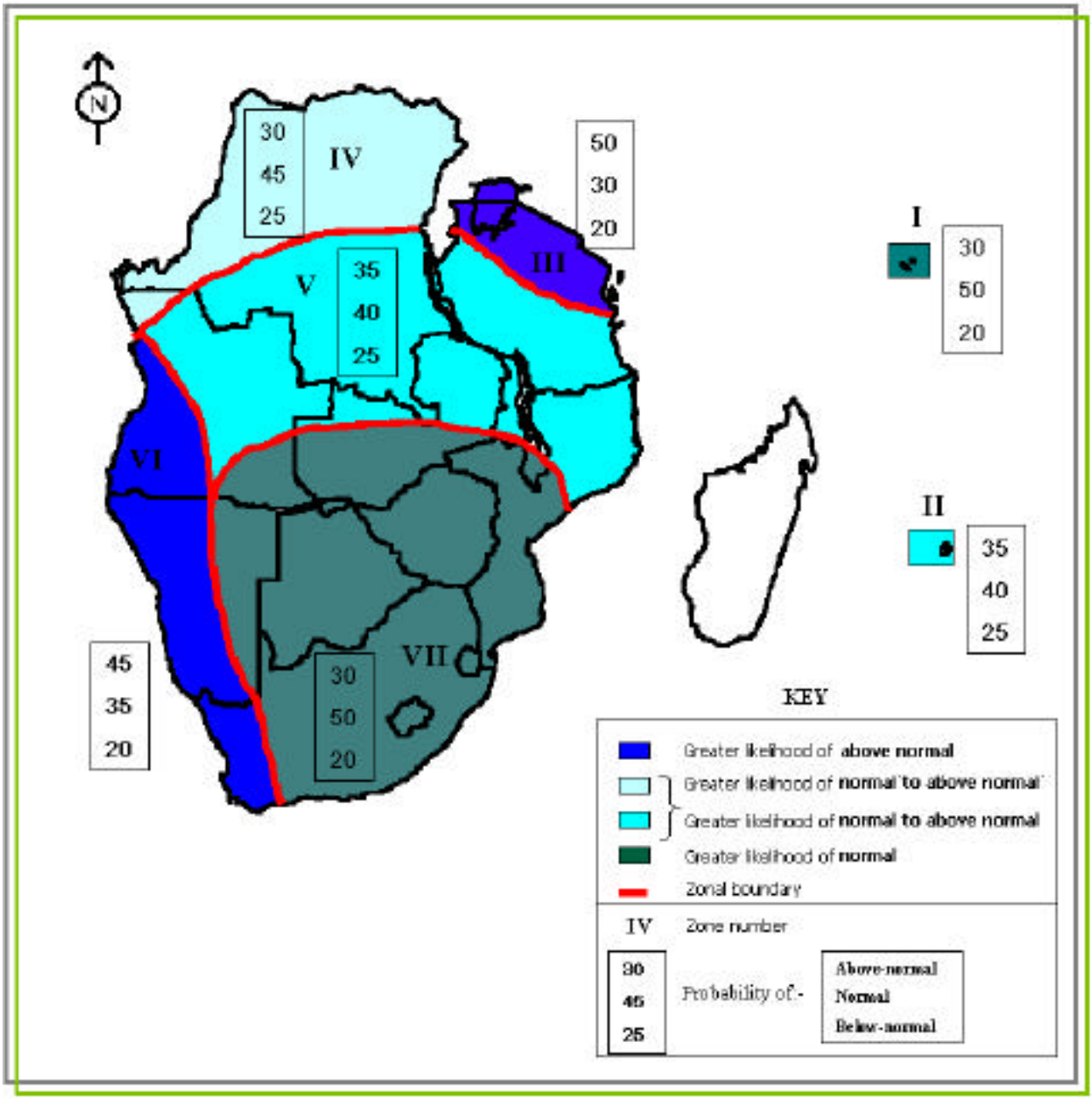
***Zone VII*** (Botswana, Lesotho, Swaziland, Zimbabwe, southeastern Angola, eastern half of Namibia, southern half of Malawi, central and southern Mozambique central, eastern South Africa, and southern half of Zambia) Likelihood of normal rainfall.

***These zones are shown on the attached Rainfall Outlook Maps of OND 2001 and JFM 2002.***

**Rainfall Outlook: October – December 2001**



**Rainfall Outlook: January – March 2002**



## MAP CAPTION

The numbers for each zone indicate the probabilities of rainfall in each of the three categories: above normal, normal and below normal. The top number indicates the probability of rainfall occurring in the above-normal category, the middle number for the normal, and the bottom for the below normal. For example, in the case of northeastern Angola and northern half of the DRC (Zone I of OND) there is a 35% probability for rainfall occurring in the above-normal category; a 40% probability for rainfall in the normal category and a 25% probability for a below-normal category. It is emphasized that boundaries between zones should be considered as transition zones.

## CONTRIBUTORS

The Fifth Southern Africa Regional Climate Outlook Forum (SARCOF-5) was organized by Drought Monitoring Centre-Harare in conjunction with Malawi Meteorological Services. Contributors to this consensus forecast included representatives of Meteorological Services from the following Southern African Development Community (SADC) countries: Botswana, Democratic Republic of Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, United Republic of Tanzania, Zambia and Zimbabwe. There were also climate scientists and other experts from national, regional and international institutions and organizations, namely: Drought Monitoring Centre-Nairobi, World Meteorological Organization (WMO), African Centre for Meteorological Application for Development (ACMAD), Universities, and Research Institutes. Additional input was supplied by the United Kingdom Meteorological Office, National Centre for Environmental Programmes (NCEP), United States, International Research Institute for Climate Prediction (IRI), United States, European Centre for Medium Range Weather Forecasting (ECMWF) and University of Zululand, South Africa. Users who participated in the deliberations of the forum contributed greatly in the final production of the statement.

# 2.0 GENERAL CONCEPTS

## 2.1 Forum Perspectives: Dr B S Nyenzi, Drought Monitoring Centre, Harare

The presentation focussed on the objectives and the expected outputs of the Forum. The participants were informed that the Harare Drought Monitoring Centre (DMCH) and the individual National Meteorological and Hydrological Services (NMHS) in the region played a major role in providing weather and climate advisories, including advance warnings on the likelihood of droughts, floods and other extreme weather events in the region. Hence the theme for the Fifth SARCOF meeting was **"Meteorological and Hydrological contributions to Early Warning, Preparedness and Natural Disaster Management in Southern Africa"**

It was stated that currently the NMHS produce the weather forecasts covering the following periods:

- 24 – 72 hours;
- 10 days;
- 1 month and
- One season.

**The Forum was informed that the forecast for period October 2001- March 2002 will focus on:**

- scientific expectation
- followed by regular updates

**It was hoped that there will be exchange of information between:**

- Meteorologists and users.

## 2.2 Role of Regional Climatic System Monitoring in Challenges of Disaster Management: B Garan'anga, DMCH

A wide variety of weather/climatological phenomena constantly pose threats to life, property and environment especially in developing countries. This has been amply demonstrated during the recent floods that ravaged southern Africa. The contribution of climate system monitoring and prediction to the economic and social development of mankind is now widely recognized. One area in which climate monitoring and prediction plays an important role is flood mitigation. Floods are more spatially concentrated and have more dramatic, instant effects. On the other hand, drought can, and often does, cover very large areas. The recurring and severe droughts that occurred between 1974

and 1984 and again in the 1990's caused widespread starvation and economic hardship to southern Africa. In particular, during the 1991/92 drought, the region spent about US$2.5 billion in drought mitigation. Although the 1994/5 droughts were just as severe, the uptake of early warning from the DMC by relevant authorities reduced the food importation bill and allowed more orderly grain distribution. The quantification of the full extent of the ravages of the more recent floods is still ongoing.

Over the whole world, about 70% of the natural disasters derive from extremes of climatic conditions. In SADC the percentage is even higher as there are no major earthquakes or volcanic eruptions that could contribute to the catastrophes. The fact that the mainstay of the economies of the region is agriculture makes climate system monitoring even more important. Other sectors such as health, power utilities, water resource management, environment also benefit from climate system monitoring and prediction.

Climate scientists worldwide are working tirelessly to unravel the intricacies of climate predictability in order to better serve the communities. As has been amply demonstrated, many sectors will benefit from more accurate predictions on various timescales.

Extensive droughts have afflicted southern Africa in recent times, e.g. 1946-47, 1965-66, 1972-73, 1982-83 and 1986-87 culminating in the most severe droughts during the period 1991-95. These times were also major El-Nino episodes.

More recently i.e. during the period 1998 - 2001 the SADC region had to grapple with floods that arose out of mainly tropical cyclones. These floods crippled road infrastructure in Tanzania during the 1997/98 El Nino episode. When La Nina conditions established themselves in 1999-2001, the disaster of flooding shifted southwards to Mozambique, Zimbabwe, South Africa and Botswana and other parts of southern Africa including Madagascar.

**Regional Drought Monitoring Centre**

Following the perennial droughts of the 1980's across most of southern Africa and elsewhere on the African continent, many meetings were held by various African governments and specialised agencies of the United Nations and other sub-regional institutions to address the problem of droughts and other adverse weather phenomena. This resulted in the establishment of two Drought Monitoring Centres (DMCs), one located in Nairobi (Kenya) and the other in Harare (Zimbabwe). The Harare centre has become a full SADC project AAA.6.02 supported with funds from the Kingdom of Belgium.

The Drought Monitoring Centres are charged with the responsibility of monitoring drought in a timely manner with respect to its intensity, geographical extent, duration and impact upon agricultural production. They must also issue early warning for impending drought and assist member states in the formulation of appropriate strategies to combat its adverse effects. To achieve this goal the DMCs carry out a number of activities.

**Activities of DMC**

The following is a sample of the range current of activities of and outputs from the DMC:

- Establishing and updating historical and near real-time regional, climatological, agrometeorological and hydrological data;

- Training personnel from member countries in drought management across the subregion;

- Participating in international fora on climatological and environmental issues;

- Establishing linkages with the existing food security early warning systems in the subregions to ensure the use of common facilities and the joint development and management of data banks;

- Collecting and processing of available information on the status of vegetation, through modern facilities established as specialized centre/services, particularly remote sensing;

- Preparing and disseminating in a regular and timely manner, relevant products and advisories on drought and other adverse weather patterns including their onset and cessation, severity and extent, etc. This involves the preparation and dissemination in map form or otherwise of relevant parameters such as rainfall and temperature anomalies, drought severity indices, drought risk, moisture stress, etc.; and

- Conducting applied research in climate monitoring and prediction techniques.

**Contribution of climate system monitoring for disaster management**

The two DMCs plays a key role in disaster management for many users, including policy-and decision-makers. A great deal has been achieved by the DMCs in informing end-users of impending droughts, floods or other climate patterns that impact negatively on many socio-economic sectors within the region.

The DMCs' products and services are of crucial importance to the operations of many users. Perhaps it is pertinent at this juncture just to emphasize that the major target groups that benefit most directly from DMCs' activities are National Meteorological/Hydrological Services, (NMHSs), planners, decision makers and relevant National, Regional and International Institutions. The DMCs have consistently issued timely information pertaining to the behaviour of the rains in eastern and southern Africa regions during the 1991/92 drought and subsequent rainy seasons. Most of the seasons had quite pronounced anomalies in the form of either drought or flooding, the latter being more predominant in the period 1998-2001.

The DMCs contribute to disaster management in an effective preparedness and response. In this regard there are essentially five overlapping phases, namely:

1. *Mitigation* - long term activities undertaken prior to impact of disaster aimed at reducing the risk of its occurrence and/or effects, diseases such as malaria, cholera etc. are tied to the extent of the climatic anomalies;

2. *Preparedness* - forecasting as accurately as possible impending disasters thereby increasing the effectiveness of subsequent emergency response during the disaster;

3. *Response* - activities undertaken to protect lives and property immediately prior to and during impact: infant feeding schemes, relocation of animals and people;

4. *Recovery* - time to build up preparedness capabilities in order to return affected communities to a more normal condition; and

5. *Data bank updating* - monitoring the occurrence, extent and intensity of all types of adverse climatic conditions

Generally, the DMCs' support to early warning encompasses contributions in all five phases. This is achieved through sensitizing the stakeholders to apply climate information and prediction services to the assessment of risk, to land-use planning and the design of structures, all of which contribute to mitigation. Special forecasts and other advice assist recovery operations.

**Institutional linkages**

Apart from the NMHS's, other beneficiaries of climate information and services can be categorised as the following decision makers:

(a) ***International relief and donor agencies***. Information can help in determining the location and nature of greatest difficulties, and import, distribution and storage requirements for food and essential non-food commodities.

(b) ***Government ministries and departments***. Climate information is applied in policy making, strategic and tactical planning aimed at the overall national well being of individuals, consumers, and commerce and industry. Actions at Governmental level could be the optimization of trading opportunities and control of import and exports, regulation of internal water and power supplies, strengthening of distribution systems, change of taxation and subsidies, and mitigation of or adaptation to large scale potential disasters that could arise out of epidemics, seawater inundation, floods, drought and desertification. Climate information can also assist policy making in multi-sectoral matters (e.g. water for power or agricultural use). Specific measures of benefit would be increased national trade margins (or reduced gaps), reduced hazard related deaths, etc.

Sectoral interests, such as farming, forestry, fisheries, water resource management, environmental quality, energy, transport, health, leisure, retail, banking, insurance, legal, construction, urban design etc. all benefit from products and other services from the DMC.

**Concluding remarks**

The DMC assists in identifying vulnerable regions and assessing the probability of recurring droughts/floods, contributing to planning and to the design of mitigation measures. Monitoring of the climate system, along with the application of developing seasonal and inter-annual predictive capability can assist in preparedness by providing an indication of the development or likely persistence of drought/flood situations. This linkage to impacts is particularly important as a trigger for response and mitigation programs. Climate monitoring and prediction services can also be of value during actual drought or flooding, and in the recovery phase, enabling Governments to assess extent and trends and to plan short-term recovery actions and longer term preventive or adaptive measures

The DMC has continued to make an impact in the region. The seasonal forecasts issued before the commencement of the rainy season have been of great use to the SADC countries. Consequently, numerous requests for information on the likely outcome of an upcoming rainy season and its progress continue to be addressed to the Centre. Furthermore, the need for better and more reliable products and services by the member countries would continue to increase in the future. The DMC will continue to adapt and develop new methodologies for improving the quality of its products and advisories.

### 2.3 Perspectives of Dynamical Modelling of the Seasonal Forecast in Southern Africa: H Rautenbach

The presentation focused on the current and predicted sea–surface temperature (SST) anomalies over the oceans and the forecast El Nino Southern Oscillation (ENSO) conditions. The most common approach to produce seasonal forecast was given as:

Step1 SST Forecast by persistence, statistics, numerical ocean models and blended or hybrid methods.

Step 2 Rainfall forecasts by statistics and numerical atmospheric models.

The presentation showed the current state of ENSO and the observed SST anomalies for August 2001. The majority of currently available predictions of ENSO from various prediction group favour neutral conditions by February and May 2002. Four models, namely CPC, ECMWF, COCA, and IRI predict neutral conditions in the SST anomalies for the period October to March.

Probability rainfall forecasts for the 2001/2002 summer season by the CCM (NCAR), NCEP- MRF, IRI (MULTI MODEL) ECMWF and COCA (CSIRO R21) models were also presented.

### 2.4 Impacts of the Extreme Weather and climate Events on River Flows and Dam Management: E M Mukuoane and E M Siamachoka

The presentation listed the functions of the SADC Water sector Coordination Unit. The SADC region experienced extreme weather and climate events on river flows by having droughts in the 1980s and floods during the 2000 and 2001 rainy season. In order to avoid problems associated with floods that severely destroyed infrastructure and caused loss of life, the Water Sector established the SADC hydrological cycle Observing system (SADC – HYCOS) project, funded by the European Union. SADC – HYCOS intended to install fifty Data Collection Platforms throughout the SADC region. One of the main objectives of this project is to receive near real time data from the hydrometric station, through METEOSAT to the Pilot Regional Centre.

The first phase of the project was completed in September 2001 and the WSCU is currently seeking fund for the second phase.

Since water is a cross cutting issue, the WS has also established the Floods and Drought Monitoring Management Programme in which the Disaster Management Centre, the Early Warning Unit and many other sister sectors are involved. Water is one of the best tools for the regional integration and international cooperation. A shocking experience of floods and droughts in the region called the attention of the SADC – WS to come up with sustainable mechanisms and/or modalities to minimize the disasters caused by floods and drought in the SADC region.

The Zambezi River Authority (ZRA) representative reported that there is close cooperation between ZRA, the Cabora Bassa Dam authorities, and other sectors in the area of reservoir and dam management in the Zambezi River Basin. To this effect, a Joint Operating Technical Committee comprising relevant institutions has been established.

The outcome of SARCOF5 will form an important input to the Committee's next meeting, which will discuss operational plans for the 2001/2002 season.

The presentation also highlighted the impact of the 1999/2000 rainy season on the management of Lake Kariba reservoir in view of Cyclone Eline, which caused floods in parts of Southern Africa during February 2000.

### 2.4 Potential Impacts of Climate Forecasts on Malaria Control with emphasis over Southern Africa: D Shambare, WHO

In Southern Africa the intensity of malaria transmission varies considerably and areas can be classified into three main groups:

· Malaria free
· Unstable transmission
· Stable transmission

In malaria-free areas transmission does not occur

In unstable transmission areas malaria is highly seasonal and occurs for only part of the year (usually less than 6 months). These areas are often prone to malaria epidemics that can result in high levels of morbidity and mortality if not prevented or contained.

In stable transmission areas malaria occurs throughout the whole year and there is relatively little seasonal variation. Malaria morbidity and mortality is greatest in these areas.

**Malaria transmission dynamics**

Malaria transmission is function of several determinants such as:

- Human carrier an Recipient (immunity)
- Mosquito vector
- Malaria parasite-plasmodium
- Environment –Climate/Economy etc
- Malaria control interventions in the locality

Major determinants of malaria transmission are temperature, rainfall and humidity. Consequently, seasonal forecasts of temperature, rainfall and humidity will give an outlook of seasonal malaria transmission. The Malaria Control Programme uses the seasonal forecasts available in Southern Africa and their processing to derive malaria outlook for the coming period.

## 2.5 Discussion

The coordinator of the DMCH warned the journalists not to make conclusions on the seasonal weather forecast until the official statement was issued later in the week.

A question was asked on the meaning of ENSO stability as it relates to seasonal forecasts. The response was that the ENSO stability means that the seasonal weather forecast based on ENSO would be difficult because the ENSO signal was not strong. The seasonal forecasters will have to rely on local predictors for them to derive the seasonal forecast.

A question was raised on the reliability of models forecasts. In response, the participants were warned not to rely too much on the models.

Participants wanted to know why the sea surface temperatures (SSTs) over the Indian Ocean were not being used for seasonal weather prediction. It was stated that some relationship between the SST in the Indian Ocean and rainfall over the SADC region have been established but the area requires further research. Recent research has shown that there is dipole effect between the SSTs in the Indian Ocean and rainfall over the SADC region.

One participant said that the seasonal climate forum is very important and the users were waiting for the seasonal forecast.

The Disaster Management Unit informed the Forum that although the previous Forum issued a forecast of floods, the Unit did not take adequate measures to prepare for floods.

A participant wanted to know the role of the individual *vis a vis* the seasonal weather forecast. In response, the DMCH informed the Forum that they study the behaviour of the atmosphere and share their findings with the user community. They provide guidance material and leave the decisions to the stakeholders. More study of the oceanic circulation has been concentrated in the Equatorial Pacific, and these studies are ongoing. A lot of time has elapsed since the First Climate Outlook Forum in 1997/1998 and there is now more awareness of the applicability of meteorological information. The stakeholders now know the value of the seasonal forecast.

The level of participation at the Forum was commended. An appeal was made for South Africa's presentation to be made during the Capacity Building Workshop. The climate outlook should not just concentrate on rainfall only because there are other meteorological variables of interest to the users. The users were warned not to expect too much from the National Meteorological and Hydrological Services (NMHSs). There is a need for close cooperation between NMHSs and various stakeholders.

Questions were raised on whether the southward migration of malaria prone areas was related to climate change, whether malaria is related to HIV and whether latitude and altitude affect the spread of malaria. In response, the World Health Organization (WHO) stated that global warming is attributed to the spread of malaria to regions, which were not previously prone to malaria. The other reason could be laxity in intervention mechanisms. Although, there is global warming the intervention mechanisms have held firm and the spread of malaria has been limited. Research is currently being done to see if there is link between malaria and HIV. The poor response of patients to AIDS drugs could be compounded by malaria. Latitude and altitude describe the geographical location of malaria prone areas. The National Malaria Control personnel were urged to work with meteorologists in order to improve their understanding of seasonal weather forecasts.

A question was raised on the accuracy of the seasonal forecast. The DMCH responded by reminding the Forum that the accuracy of the forecast was not a simple issue. The forum was aiming at producing a forecast which was better than climatology. The seasonal rainfall forecast was grouped into three terciles of below normal, normal and above

normal. The uncertainty in the forecast should be specified, and the main aim is to narrow the uncertainties in the forecast. The forecast cannot be perfect.

# 3.0 GENEARAL CONCEPTS IN CLIMATOLOGY

## 3.1 Developments in Framing Climatic Prediction Products in Ways Most Effective in Influencing Planned Socio-Economic Decision Making: A W Manjugu

The presentation centred on how the phases of the El Nino and Southern Oscillation (ENSO) can be used to develop climate prediction products and their influence in decision making.

Currently seasonal prediction products in the SADC region are expressed in probability levels under the categories of above normal, normal and below normal. The main predictors being used are the sea-surface temperatures over the Equatorial Pacific Ocean and the ENSO indices. In the final analysis the categories of above, near normal and normal correspond to the different phases of the ENSO cycle. This is particularly so when the score indicate strong bias towards any of the three categories.

There have been some developments in framing climate prediction products in ways most effective in influencing planned socio-economic decision making by establishing the mean rainfall patterns that correspond to the different main phases of the ENSO cycle, in particular the El Nino and La Nina phases.

These rainfall patterns can now be used as reference mean patterns to categorize the predicted rainfall probability levels in terms of the ENSO based rainfall patterns. The identified rainfall patterns are now expressed in factors related to the likely onset of the rainfall season, the level and duration of periods of rainfall enhancement/suppression and the likely cessation of the season, thus the duration of the season. These are factors which are more effective in influencing planned socio-economic decision-making. Some of the decisions relate to:

(i) Timing and scale of land preparation;
(ii) Choice of appropriate crops/seeds to distribute/grow and timely distribution;
(iii) Timing of the planting periods, and
(iv) Programming the farm activities.

## 3.2 The Role of Agricultural Extension Workers in Utilization of Seasonal Forecast: D Nyoni/D Simela

The presentation listed the role of extension agents as:

(a) Actively sourcing, interpreting and disseminating seasonal forecast information to farmers;
(b) Extension Agents should identify local indigenous forecasters and work with them to build confidence of the forecasters and also encouraging a change of "mindset" among farmers so as not to have negative views towards indigenous technical knowledge (ITK);
(c) Link seasonal forecast information to farmers' socio-economic factors;
(d) Collaborate with meteorologists/agrometeorologists to identify effective ways of communicating seasonal forecast information to users and feedback to forecasters so as to develop a culture of integrating seasonal forecasts into all farming operations;
(e) Participate in user education activities on long lead seasonal forecasting, and
(f) Participate in research efforts to establish the levels of utilization of seasonal forecast information, identify socio-cultural factors that affect utilization, document and share such experiences in order to build confidence of users and inform future decision support system development.

It was pointed that the seasonal forecast information is available to twenty percent of the farmers. Lack of utilization of the seasonal forecast can be attributed to the following:

- Information delivered does not math the information required, and
- Lack of trust between potential users and forecast providers;
- Inadequate communication of forecast information;
- Limited ability to respond by changing once information on weather events has been received.

The following are the requirements of the Agricultural Extension Workers:

(i) Training in the interpretation of seasonal climate forecast and linkages with farm management;
(ii) Improved linkages between Extension practitioners and meteorologists to facilitate collaborative efforts;
(iii) Provision of user friendly literature on seasonal forecasting;
(iv) Organizing open days for extension staff at meteorological stations to expose personnel to the climatology field so as to build appreciation and create bonds between agriculturist and meteorologists, and
(v) Speed –up communication of seasonal forecast information to Extension personnel prior to the onset of each season.

### 3.3 Promotion and Integration of Indigenous Knowledge in Seasonal Climate Forecasts: M Kingamkono

The presentation highlighted results of a project whose main objective was to try to integrate indigenous knowledge in seasonal climate forecasts in order to enhance the predictive capability of respective models. The specific objectives of the project were to:

- document indigenous climate indicators;

- carry out preliminary investigations into the relationships between the indicators and climatic variables, and
- to develop a methodology for incorporating indigenous knowledge into the conventional climate forecast models.

Results of the study indicate that:
- indigenous predictors are related to meteorological parameters
- indigenous predictions were at variance with SARCOF rainfall outlooks, and
- local people's predictions were much closer to reality for the areas used in the study.

Correlation analyses were made between the Aridity Index (AI) and some meteorological parameters. The AI combines parameters which describe the quality of the growing season. The higher the index is, the better is the growing season. Significant correlation coefficients were found between AI and mean temperature, mean maximum temperature, mean relative humidity and mean wind speed for Dodoma and Arusha.

### 3.4 Assessment of Communication and Use of Climate Outlooks and Development of Scenarios to promote Food Security in the Free State Province of South Africa: S Walker, E Mukhala, W J van den Berg & C R Manley

The need for reliable seasonal climate outlooks is becoming increasingly important for farmers and related agro-industries. In order for climate outlooks to be useful, it must satisfy the following requirements:

(i) The information must be reliable but more important, accurate;
(ii) The information must be applied to specified agricultural practices and commodities;
(iii) The end-user must not only be able to have access to the information BUT must be able to interpret, understand and apply the information in such a way that he will gain financially, and
(iv) The information must always be presented and interpreted in terms of financial norms. A high yield can result in low prices and vice versa.

The study addressed some of the issues mentioned above. The study was divided into three parts.

**Part A concentrated on the communication of the seasonal outlooks to the end users.** For successful communication of the message, there needs to be shared meaning between the farmers as end-users and meteorologists as the senders. A survey was done to determine whether farmers receive the seasonal climate forecasts and to check if farmers understand the terminology used in the forecasts.

The survey showed that less than half the respondents do not receive the seasonal forecast, and this was independent of farm size. The results also showed that 93% of the commercial farmers perceive that they understand the technical terms, however about half of them cannot define the technical terms correctly. It was also found out that more than half the respondents trust the forecasts most of the time and 40% will make adjustments to their farming practices based on the information received.

**Part B of the project provided training seminars for extension and research staff and some small-scale farmers in the Free State.** Two training seminars were conducted in October 2000 in two provinces. They provided a detailed explanation of ENSO and its relationship to the rainfall in South Africa together with the consequences for summer dryland maize production. The seasonal outlook (2000/2001) was also discussed and recommendations were made for changes in various farming practices. The training seminars were successful and additional topics and information needed by the farmers was also requested. It is recommended that the seminars should be held annually in many provinces of South Africa.

**Part C concentrated in developing and testing seasonal climate outlook models that can be used as climate inputs for crop growth modelling or simulation process.** The aim was to provide more applied or value added seasonal outlook information and to make yield estimate for a specific season. Three different models were used in the study. The models were evaluated in terms of both the spatial rainfall distribution and maize yield distribution in the Free State Province. Results indicated that spatially forecast rainfall total (October – March) for the five years that were investigated were in general satisfactory, with an underestimation trend evident in most years. Spatially correct yield estimates produced different results with mixed performance by the three models.

### 3.5 Economic Benefit of Applying Seasonal Climate Forecast in Hydro-Power Management: H Sinyangwe

The application of the seasonal climate forecast is of great economic benefit to the hydropower utilities. It gives time for planning and strategizing in trying to minimize the impact of any extreme of the rainy season, that is, floods or drought conditions. The economic value is not just hydro-power management, but it also benefits other stakeholders such as farmers, fishermen, commercial industries, municipal councils, the environmentalist and other local settlers in the vicinity of the water catchment who have access to the controlled water for power generation.

### 3.6 Lessons and Measures to Mitigate Flood Disaster in Mozambique: B M Chivambo

The presentation described the Flood Disaster Management Programme in Mozambique as follows:

· Pre-flood Activities: There are short term, medium and long term measures;

- Operational Flood Management: It comprises the detection of the likelihood of flood conditions developing, Forecasting future river conditions, Warning and Daily surveillance of river flow;
- Strengthening of Institutional Coordination;
- Strengthening of Regional Cooperation;
- Rehabilitation/Installation of Hydrometeorological Stations;
- Preparedness and contingency Planning;
- Early Warning Information Systems;
- Construction of protection dikes and refuge platforms;
- Creating inland storage capacity.

The mitigation and management of flood disaster of 2001 involved the following measures:

- Mobilization of funds;
- Better Operation of EWS;
- Adequate forecasting and spread of information;
- Coordinated surveillance with stakeholders;
- Coordinate operation of dams and reservoirs, and
- Emission of 80 daily hydrological information through the department, radio, newspapers, television and internet.

### 3.7 Economic benefit of applying seasonal climate forecasts for farm management in Zimbabwe: R Mano

Rainfall plays a crucial role in small holder agriculture and most of the small holder farmers depend on seasonal rainfall for their crop and livestock production. In Zimbabwe the small holder farmers are supplied with seasonal forecast information before the start of the rain season. The forecasts are issued with the hope that the small holder farmers may make use of them in making their farm management decisions. Thus, the main goal of the study is determine whether correct application of the forecast information in smallholder farm management yields any economic benefits for small holder farmers. Some farmers make use of the forecasts because they have access to strategic inputs while others do not have such kind of inputs. The project will also try to identify the constraining factors in terms of seasonal forecast information use by the small holder farmers.

The project results will be used to justify investment in long-range and seasonal climate forecast research and infrastructure in small holder agriculture development. The results will also be used to promote appropriate and effective communication channels, which can enable small holder farmers to utilize this scientific knowledge for smarter and optimal agricultural management decisions.

**Note: The methodology and some of the preliminary results of this project are contained in the DMC:SARCOF REPORT NO 7**

### 3.8 Climate Information for Agricultural Decision Making for Sustainable Agricultural Production in the SADC Region and Food security in the SADC Region: E Mukhala

The main decisions by a farmer are:
- What to grow;
- Where to grow;
- When to plant, and
- How to cultivate.

These decisions need to be supported by information such as:

- Seasonal Climate Forecast
- Mean annual rainfall
- Start of the growing season
- Length of the growing season
- Characteristics of staple crops
- Crop water use pattern, and
- Soil Characteristics.

The advantages of this approach are:

- Objectivity;
- Best use of source data;
- Higher resolution/More detail;
- Open to cross feeding with remote sensing data and global climatological analysis (ENSO);
- Open to calibration and validation, and
- Potential development to yield/production forecast modelling.

With such information:
- Best strategies will be used;
- Appropriate crops will be grown;
- Financial losses will be minimized, and
- Agricultural production will be sustained.

## 4. REVIEW OF THE 2000/2001 RAINFALL SEASON

### 4.1 Review of the 2000/2001 Rainfall Season in West Africa: ACMAD

ACMAD presented the performance of the 2000/2001rainfall season over the West Africa. A review of the current state of the global climate with respect to its influences over the West African region was also given.

Capacity building workshops were held in the centre before the issue of the climate forecast. Stakeholders' workshops were held separately and this tackled the issue of climate information transportation from the producer to the user.

Rainfall forecasts updates were and are issued by the centre. As the region is still in its rainfall season an assessment of the 2000/2001 rainfall season will only be made at the end of the season

### 4.2 Review of the 2000/2001 Rainfall Season in Eastern Africa: DMCN

The participants were informed that the Eastern Africa region has two rainy seasons. The Eastern Africa region received below normal rainfall during the first part of the season. Since the low rainfall scenarios commenced, experiences are that, more damage was evident in the various socio-economic sectors and these included Agriculture, Wildlife, Energy, etc.

Heavy rainfall in January, though unseasonal, brought a relief over Kenya and the region started recovering from the catastrophe that was experienced for the previous at least two years, although the recovery process is very slow.

Several impacts, some positive and some negative were realised and they are being seen in several parts of the region.

### 4.3 Review of the 2000/2001 Rainfall Season in Southern Africa: DMCH

The presentation highlighted the importance of rainfall and the accuracy of the seasonal rainfall forecast to socio-economic activities of the region. It was pointed that in general rainfall over the SADC region occurs from October to March except for the northern sector of Tanzania where rainfall is bimodal. The climatology of the SADC region from November to March was described in detail. Maps of the showing Tropical cyclone activity in the Indian Ocean and the station network used by the DMCH in the rainfall analyses were presented.

Monthly analysis of rainfall was presented in the form of accumulated rainfall for:

- October 2000
- October – November 2000
- October - December 2000
- October 2000 – January 2001
- October 2000 – February 2001
- October 2000 – March 2001

The SADC region received normal to above normal rainfall during the 2000/2001 rainfall season but the distribution was not uniform with January being unusually dry.

The impacts of the rainfall season were reviewed on a country basis and these included:

- Flooding which resulted in damage to property, loss of life and destruction of cropland. The countries most affected by flooding were Mozambique, Malawi, Zimbabwe and Zambia. Minor cases of flash floods with landslides were reported in Botswana, Namibia, Seychelles and Angola. The flooding was exacerbated by the opening of floodgates because the dams experienced more inflow than outflow;
- Destruction of bridges, houses and other infrastructure;
- Waterlogging and fertilizer leaching resulting in reduced yield;
- Infrequent rain during the first quarter of the rainfall season over the southwest of SADC led to heat and moisture stress causing diminished harvest and shortage of food.

### 4.4 Verification of the 2000/2001 SARCOF Product: B Garan'anga, DMCH

The presentation outlined the forecast verification at regional level showing how good or bad the forecast was including the update and the initial forecast issued in September 2000. Monthly rainfall maps for the SADC region showing the observed and predicted seasonal rainfall were presented. The presenter who also presented the behaviour shown by the forecasts issued discussed the SARCOF forecasts (initial and update) in detail. Somehow the initial forecast was better that the update in some parts of the region.

During the discussion that followed concerns were raised on the desire to increase the number of rainfall stations on the surface by including remote sensed data in the forecast verification process. It was pointed out that there is a very short series of satellite data.

Clarification was sought on whether the word Monsoon was the same as the ITCZ. It was stated that the two were not the same. Monsoon referred to the northeasterly airflow which was one of the airmasses of the ITCZ.

Participants also queried whether the abnormal rains in the region were representative of the longer time scales. It was stated that these were only temporal variations which could not be attributed to changes in the climate.

### 4.5 Review of the 2000/2001 Rainfall Season from the Users' Perspective by Country

Each SADC country that attended the Forum shared their experiences during the 2000/2001 rainfall season and the impact of the rainfall season on the various sectors' activities. In addition there were presentation of lessons learnt' by the users from the process of the previous climate outlook forums.

#### 4.5.1 Botswana

Malaria was kept under control.

### 4.5.2 Lesotho

The ex-mines association in the country who are now engaged in farming gave a review. The representative highlighted the conditions that the farmers do not understand the forecast and thus required someone to interpret it and help them apply the forecast in their farming activities.

### 4.5.3 Democratic Republic of the Congo (DRC)

The review is not available because the country was in civil war in the recent past and all weather stations were destroyed.

### 4.5.4 Malawi

The users highlighting the heavy rains that destroyed infrastructure in the country presented one report. These were mostly experienced in the latter part of the season.

### 4.5.5 Mauritius

Usually the month of October is dry. The tropical cyclone season starts in November until March and these are main rain-bearing systems. It should be noted that about 80% of the total annual average rainfall was recorded in January 2001.

The Mauritius Meteorological Services issued its Summer Seasonal Outlook for the year 2000-2001 on 3 November 2000. The forecast was for a normal rainfall but with slightly more active cyclone activity in the southwest Indian Ocean. The forecast given by SARCOF for the season was a major input.

Mauritius recorded a mean rainfall of 1214 mm. On the other hand, there were only five named tropical storms, out of which four intensified into tropical cyclones. The forecast given by SARCOF proved to be correct as it went for normal rainfall over Mauritius.

### 4.5.6 Mozambique

Problems were faced in the central part of the country concerning flash floods. There are bulletins issued by the water sector and these use inputs from the SARCOF and INAM.

### 4.5.7 Namibia

A relationship between rainfall and malaria showed a close correlation although there was a time lag. The malaria disease was outside reach of the control unit in the country.

### 4.5.8 South Africa

Farmers in the dry-land areas were affected adversely and more especially those cultivating the indigenous crops. Health had a normal season.

### 4.5.9 Swaziland

**Forecast**: OND (2000) – above normal
JFM (2000) – Normal to above normal

**Health** - Use forecast to control possible Malaria epidemic
- Period from January 2001 to February 2001 experienced dry spell.
- Malaria kept under control

- Occurrence of rainfall towards end of March Malaria outbreak shifted from what was expected

An unexpected outbreak of Cholera also occurred in March.

**Water Resources**

- Increase in river levels recorded in November and early January
- Decrease in river levels recorded in January to late February
- An increase in river levels again recorded in March. This basically followed the rainfall pattern.
- Problems in effectively utilizing forecast

- There is a need to refine the forecast. i.e. define
  - Onset, cessation and duration of rainfall
  - Determine distribution and intensity of rainfall
  - Forecast is an accumulation/overage of 3-months; A need for shorter time spans for effective water appointment/supply especially in operation of reservoirs and in the application of hydraulic models.

**Agriculture:**

- Two mid-season dry spells were observed;

  November to December (2000), then violent weather was experienced in the first day of January (2001) then after a prolonged dry spell was experienced from January to February. This resulted in damage to crops that were at critical stages of development.

**Media:**

- Public complained forecast was inaccurate, as many could not clearly understand the concepts like ‘normal’, ‘above normal and below normal’.

- Need to clearly explain this concept to users

- Need again to define onset, cessation, and duration of the rainfall event, determine intensity, for the different stakeholders to effectively utilize the forecast.

### 4.5.10 United Republic of Tanzania

**OUTLOOK**: Normal to below normal

PERFORMANCE

North Eastern: Normal to above normal. Onset was delayed

Short rain: Mid-October (third week)

Response: Planting maize + beans * - Good harvest

Long Rains

Delayed onset
*Above normal Response* as short rains

Southern Sector/SW

Outlook: Normal to above normal

Performance
- Above normal
- Poor distribution
- Delayed onset

Response
- Good harvest maize, paddy
  *Prices of food stuffs dropped

### 4.5.11 Zambia

· The 2000/2001 seasonal forecast was issued to the users in early October 2000.
· The forecast was timely (in terms of dissemination to the users).
· The forecast was for normal to above normal rainfall over the whole country.
· A public awareness campaign was done particularly to the vulnerable communities prone to either floods/drought.

- The rainfall received during January, February and March, was normal to above normal over the whole country in agreement with the forecast.
- From the hydro-prone point of view, the northern half of the country received above normal rainfall in OND while the southern half received below normal rainfall.
- Flooding/dry spells were experienced in February and March
- An impact assessment was done in 43 districts reported to have been affected by the adverse weather conditions
- Findings indicated that there was damage to environment and infrastructure and there were also impacts on health, water and sanitation.
- A Disaster Relief Programme was embarked on or implemented in the areas that were effected.

The forecast was as predicted on the ground.

### 4.5.12 Zimbabwe

The Department of Meteorological Services hosted a seminar in which the downscaled climate outlook for the 2000/2001 rainfall season was presented to the users. Both the OND and the JFM forecasts ware correct but there was a prolonged mid-season dry spell during January 2001 which brought problems mostly to the farming community. There were floods in February and March which resulted in loss of life, destruction of property and the displacement of many people. There was also an outbreak of cholera in the country.

### 4.5.13 Discussion

In the discussion that followed the users raised concerns on the issue of the mid-season dry spells and start of rains. The users pointed out that the climate outlook would be more valuable if the onset of the rains and the intra-season variations of the rains were provided. The resolution of the forecasts to shorter time scales was desired and these shorter time scales forecasts will pick the dry spells and the start of the season.

The climatologists informed the users that research was ongoing in formulating models which can predict the intra-season variations. However, the Drought Monitoring Centre informed the users that they issue ten-day bulletins during the rainy in which the dry spells can be forecast. The users were also informed that short-range forecasts and are issued by the National Meteorological and Hydrological Services (NMHS). Some NMHS also issue ten-day bulletins during the rainy season.

The users requested the SARCOF process to make a temperature and humidity forecast because the parameters were needed in the prediction of malaria.

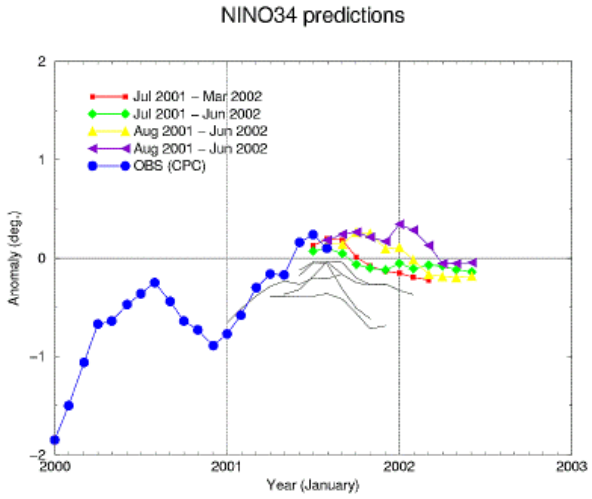
# 5. FORECAST PRESENTATION

## 5.1 Review of the Current State of the Global Climate: H Rautenbach

The presentation started by showing the current state of the El Nino – Southern Oscillation (ENSO). The observed sea surface temperatures (SSTs) during August 2001 were also presented. A review of the forecast SSTs by the International Research Institute (IRI) for October-November-December 2001 and January-February-March 2001 was given. This was followed by a review of the SST forecasts from European Centre for Medium Range Weather Forecasts (ECMWF) for the period November 2001 to January 2001. Monthly forecasts of the SSTs for the period November 2000 to February 2001 by the Coupled Oasis CAR-AGCM ACOM2 (COCA) model were also presented.

**COCA**

**The four recent predictions tend to indicate neutral conditions by summer. The two most recent predictions from (August 1) indicate slightly positive anomalies for a few months which eventually decay by early next year. There is still no indication of the development of persistent warm conditions.**




Most model predictions favoured neutral ENSO conditions by February and May 2002. A majority of the models predicted some warming in the Equatorial Pacific Ocean in either six or nine months' time.

A summary of the ENSO forecast by different models for February 2002 and May 2002 is shown below.

**FORECAST ENSO CONDITIONS FROM AUGUST 2001**
**CURRENT CONDITIONS ARE NEUTRAL**

| GROUP | 6 MONTHS (Feb 2002) | 9 MONTHS (May 2002) | |
|---|---|---|---|
| Bureau of Met 1 (NMOC) | Not Available | Not Available | CM |
| Bureau of Met 2 (BMRC) | Neutral | Warm | CM |
| CSIRO (COCA) | Neutral | Neutral | CM |
| CCA | Neutral | Warm | ST |
| COLA | Cold | Cold | CM |
| ECMWF | Warm | Not Available | CM |
| LDEO (4) | Neutral | Not Available | CM |
| NCEP | Neutral | Neutral | CM |
| NOAA LINEAR INVERSE | Neutral | Neutral | ST |
| SCRIPPS/MPI | Warm | Neutral | Hybrid |
| NSIPP/NASA | Neutral | Neutral | CM |
| JMA | Neutral | Not Available | CM |

The majority of currently available predictions from various prediction groups favour neutral conditions by February and May of next year. There has been slight cooling in the NINO4 and NINO3 regions during the past month. Despite this, a majority of the models still predict some warming in the coming period with five of twelve models showing WARM conditions in either 6 or 9 months' time.

## 5.2 Regional Sea Surface Temperature Anomalies and some Preliminary Model Results: C Reason

A review was given of interannual sea surface temperature (SST) patterns in the South Indian and South Atlantic Oceans that are important for southern African rainfall variability. The most important mode is the El Nino Southern Oscillation (ENSO) but other recently proposed interannual patterns in the South Indian Ocean include the so-called tropical dipole mode (Saji *et al.*, 1999) and the South Indian Ocean subtropical dipole mode (Behera and Yamagata, 2001; Reason, 2001). The relationships between these dipole modes and ENSO are not well understood but there appear to be similarities in some of the ocean-atmosphere interactions that occur in the Indian Ocean during ENSO and the dipole mode events (Reason *et al.*, 2000). The tropical dipole mode has been suggested as being influential on East African rainfall while the subtropical dipole mode appears more closely linked to rainfall in a band stretching south from western Zambia, Zimbabwe through South Africa.

Interannual SST patterns in the South Atlantic and Southern Oceans may also influence southern African rainfall. The Antarctic Circumpolar Wave phenomenon (White and Peterson, 1996) may involve interactions between the Southern Ocean and the subtropical South Atlantic and Indian Oceans on interannual time scales and may also need to be considered for African seasonal forecasting purposes.

The second part of the talk presented some preliminary results from the atmospheric modelling part of the South African DACST funded seasonal forecasting project of the Universities of Cape Town, Pretoria and Zululand and the South African Weather Service. Three experiments for the 2000/2001 summer season were performed with the

UKMO HADAM3 general circulation model. In experiment 1, the model was forced from October 2000 to April 2001 with the SAWS CCA forecast SSTs for this period, while experiment 2 used observed SSTs during the ensemble integrations. The third experiment involved forcing the model for the same summer period but with the observed October 2000 SST anomaly imposed on the monthly climatological fields for this period (the persistence experiment). The objective of these experiments was to assess the sensitivity of the model to different SST forcings and to get an idea of its ability to represent atmospheric circulation anomalies over the southern African region given realistic SST forcing. This work is a necessary prelude to producing a dynamical model based seasonal forecast later in the project. The analysis of these experiments is currently underway and will be reported on in the scientific literature in the future.

**References:**

Behera, S.K. and T. Yamagata, 2001: Subtropical SST dipole events in the southern Indian Ocean. *Geophys. Res. Lett.*, **28**, 327-330.

Reason, C.J.C., R.J. Allan, J.A. Lindesay and T. Ansell, 2000: ENSO and climatic signals across the Indian Ocean basin in the global context: Part I, interannual composite patterns. *Int. J. Climatol*., **20**, 1285-1327.

Reason, C.J.C., 2001: Subtropical Indian Ocean SST dipole events and southern African rainfall. *Geophys. Res. Lett*., **28**, 2225-2228.

Saji, N.H., B.N. Goswami, P.N. Vinayachandran and T. Yamagata, 1999: A dipole mode in the tropical Indian Ocean. *Nature*, **401**, 360-363.

White, W.B. and R.G. Peterson, 1996: An Antarctic circumpolar wave in surface pressure, wind, temperature and sea-ice extent. *Nature*, **380**, 699-702.

### 5.3 Rainfall Predictors used in Southern Africa: B Chipindu

The presentation outlined the potential rainfall predictor for the Southern African region.

The predictors can be classified as:

- Analogue;
- Statistical;
- Statistical-physical, and
- Physical-numerical.

The statistical techniques which can be used as climatic predictor are:

- Time series;
- Persistence and trends;
- Periodicities, and

· Teleconnections.

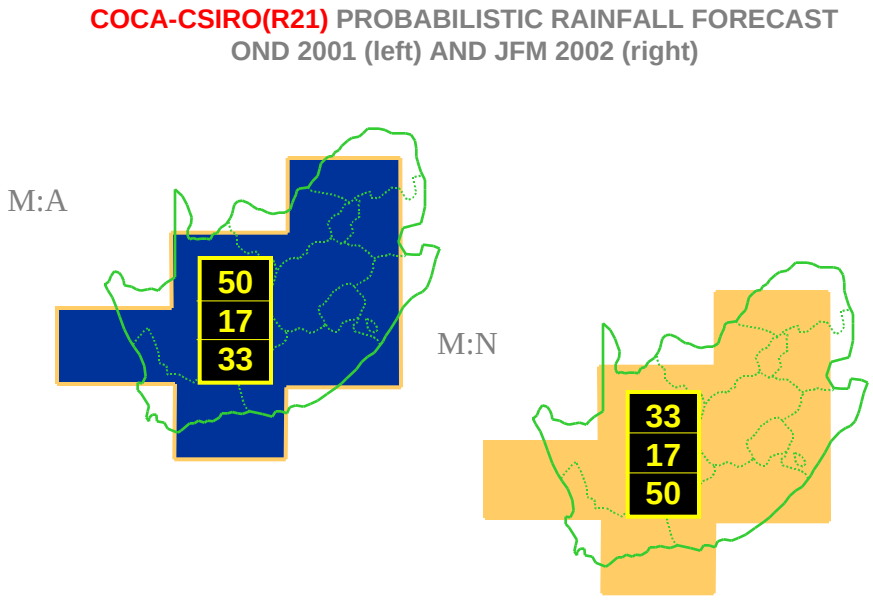
Some of the teleconnections which were utilized in the production of the seasonal rainfall forecast were the El Nino – Southern Oscillation (ENSO) and the sea surface temperature (SST) anomalies in the Atlantic, Indian and Pacific Oceans.

### 5.4 Seasonal Forecast Presentation by Country

Each SADC country, which participated in the pre-SARCOF capacity building workshop that was held in Harare, Zimbabwe during August and September 2000, presented a summary of their seasonal rainfall forecast. Details of these results are contained in a separate report by the DMCH. The seasonal forecast for South Africa was formulated using a different method.

### 5.5 Forecast Presentations by International Centres and other Institutions

The probabilistic rainfall forecasts for the 2000/2001 summer season by the following models was presented: CCM (NCAR), NCEP – MRF, IRI (MULTI MODEL) and ECMWF. Most of the models predicted a high likelihood of normal rainfall over most of the SADC region. The COCA (CSIRO R21) probability rainfall forecast for South Africa is shown below:



### 5.5.1 DMC-Harare

During the period October-November-December (OND), DMC Harare divided the subcontinent into four regions. There are high probabilities of **above normal** rainfall over northwestern Angola and northern DRC. Over much of Angola, southern DRC, northern Malawi, central and northern Namibia, southwestern South Africa, southern sector of Tanzania, and northern Zambia, there are high probabilities of **normal to above normal** rainfall. There is a likelihood of **normal to below normal** rainfall over Botswana, Lesotho, southern Malawi, central and southern Mozambique, southern Namibia, most of South Africa, Swaziland, northern sector of Tanzania, southern Zambia and Zimbabwe.

During January-February-March (JFM), DMC divided the sub continent into three regions. Over northern DRC, there are high probabilities of **above normal rainfall**.

Angola, southern DRC, Botswana, Lesotho, Malawi, Mozambique, Namibia, much of South Africa, Swaziland, southern Tanzania, Zambia and Zimbabwe are expected to receive **normal to above normal rainfall**. Over the southwestern tip of South Africa, there is a high probability of **normal rainfall.**

## 6. FORMULATION OF THE 2001/2002 CONSENSUS CLIMATE OUTLOOK

The climate scientists considered all the forecasts from the NMHSs, international and regional centres and they formulated a consensus climate outlook for the SADC region. More weight was given to the zoning from the outputs of the representatives of the NMHSs attending the workshop. However, in arriving at the probabilities, considerable attention was given to the skill of the available models.

A drafting committee was then set up to formulate a draft statement to be tabled before the plenary.

## 7. USERS' NEEDS

The users were sub-divided into the following sector teams: Energy and Water, Agriculture and Food security, Health, Disaster Management and Media. The sector teams discussed their requirements from the forum. The needs of all the sectors were summarized in the users' recommendations ( See Section 11.3).

## 8 FUTURE SARCOF PROCESS GROUP

The directors of the NMHSs, representatives of the directors of the NMHSs, the coordinator of the DMC and the representative of the Director of the World

Meteorological Organization held a meeting to discuss the future of the SARCOF Process.

# 9 DISSEMINATION OF CLIMATE FORECASTS

## 9.1 Towards a Seasonal Hydrological Forecast: K O Asante

The presentation focussed on how a seasonal climate forecast will be used in formulating a hydrological forecast. Examples were given of how the climate outlook will be used to mitigate flooding in the Zambezi valley.

## 9.2 The Role of the Media in the Dissemination of Seasonal Forecast: E Mrutu

The presentation highlighted the role of the media in dissemination of seasonal forecast through the print and electronic media. The print media includes newspapers, magazines and newsletters while the electronic media comprises televison, radio, film and video. Alternative media are posters, flipcharts, flyers and bumper stickers. Traditional media includes songs, dances and plays. Interpersonal communication comprises meetings, rallies and discussion groups.

Meteorological experts can disseminate the seasonal forecasts through radio and television programmes or they can pass the information media institutions that will disseminate the seasonal forecasts.

Success in the dissemination of information on seasonal forecasts in the SADC region could be achieved if there was greater cooperation between media institutions and meteorologists.

The roles of the media in society in the dissemination of seasonal forecasts should be based on information, interpretation, expression and mobilization.

Regarding information provision, the media roles fall under selection, information dissemination and education of the public.

Another role of the media in the dissemination of seasonal forecast is to make interpretations based on editorial opinion, giving background information, commenting and mobilizing through active campaigns like advising farmers to prepare their farms for timely planting.

In the case of broadcasting through either radio or television, the meteorologists should use simple language which does not confuse the public.

## 9.3 Users' Views and Experiences on the Ways the Climate Forecasts are Disseminated: B W Gidala

The importance of the seasonal climate outlook for the SADC region cannot be underrated because the frequency of climate related disasters has increased. There is a need for a coordinated approach to the problems besieging the region.

After the Fourth Forum in September 2000, the Malawi Met Services (MMS) held a press conference for both print and electronic media where the national forecast was presented. The seasonal climate forecast was also sent by mail to several users. Throughout the season the MMS kept users updated on a constant basis through telephone, radio, television and e-mail. Policy makers were also briefed on the seasonal forecast until the end of the season,

There were problems associated with the seasonal forecast. Firstly, the onset of the rains did not follow the expected. The onset of the rain is normally expected to start from the south and gradually move northwards. The onset of the rains was uniform over the whole country and many farmers and other stakeholders were unprepared. Farm input distribution was behind schedule. Secondly, the there were complaints at all levels that the language used in disseminating the climate forecast was too scientific for the users. Lastly the forecast did not reach all the users, because most of them do not have access to both print and electronic media. The Agricultural Extension Officers might not have passed on the right information to the farmers.

The Department of Disaster Preparedness, Relief and Rehabilitation made contingency plans based on the seasonal forecast. However, the targeting went wrong following the outlook forecast because the department targeted those areas which usually experience floods during a normal rainfall season. The department was caught unaware when in December, flooding occurred in a district where no flooding had been reported in the recent past causing loss of lives. The heavy rains caused flooding in the highlands which had never experienced floods before.

The excessive rains mid season rains drastically reduced crop production in Malawi. The prolonged season made those crops which had matured by the end of March to rot due to excessive rains and lack of sunshine. Since Malawi's economic livelihood depends on agriculture, this had negative effects on the country's food security and people's incomes.

### 9.4 Brief on RANET (Radio and Internet Connection to Rural Areas), Zambia Experience: Lt Col N'gambi

The RANET process in Zambia comprises of the following steps:

STEP 1: National workshop on 22 September 2000

STEP 2: National consortium (Experts Committee), Sept 2000

- Core Implementation Committee, Sept 2000
- Formation of National Information Gathering Centre, Sept 2000

STEP 3: Resource Mobilization

STEP 4: Meeting with the National Consortium of Experts, January 2001

STEP 5: Equipment Collection and Installation

STEP 6: Meetings with Farming Groups, February 2001

STEP 7: Training of Technical Committee, Animators and Management Committee, March 2001

STEP 8: Monitoring and Evaluation, April – June 2001

STEP 9: Compilation of Reports to ACMAD and Donors, June and July 2001

### 9.5 Experience of the 2000 – 2001 Seasonal Forecast in South Africa: C P Modika

South Africa was expected to receive near normal to above normal rainfall during the 2000/2001 rainfall season. There was a heat wave during January which resulted in hot and dry conditions throughout the country. The different sector had the following experiences:

AGRICULTURE: No severe damage in crops occurred but the dry spell in January reduced yield;

HEALTH: No sever malaria epidemics. Cholera epidemics were reported in KwaZulu Natal;

WATER: Most dams filled because of good rains during previous seasons. There was water restriction in Western Cape due to less rain in previous seasons. However, the region has received good rains during the winter.

### 9.6 Using the Seasonal Forecast for the Small-scale Farmer: Dr E Mellaart

The presentation outlined the results of a study which was done by the Instituted of Soil, Climate and Water in South Africa. The aim of the study was to assess the impact of seasonal rainfall forecast in mitigating adverse weather conditions on rural small-scale farmers in selected communities of South Africa. The first group of farmers in a selected area carried out their activities as though the 2000/2001 season was going to be above normal. The second group acted as though the season was going to be normal. The third group acted as though the season was going to be below normal. The fourth group carried on their farm activities without reference to the seasonal forecast or any other climatic information.

An assessment of the performance of the four groups of the farmers was done at the end of the season.

At the end of the project the following observations were made:

- Farmers and extension services showed interest in seasonal weather forecasts;
- The weather in the research area did not correspond to the expectation;
- No conclusion on maize variety: difference in variety higher then difference in management;
- Some farmers' yields were not limited by weather conditions;
- Late fertilization on maize was successful;
- Minor irrigation on groundnut was successful, and
- The project was instructive for the farmers, the extension officers and the researchers.

## 9.7 The Use of Climate Information in Health Services in the Democratic Republic of Congo (DRC): Prof L Mbenzi

The representative from WHO indicated that there were a number of health factors related climate. Therefore WHO would like to work with meteorologists with an interest in health issues to conduct research in these areas. It was pointed out that people's diet is related to seasons and in Africa, the rainy season is the season that gives the people food. It was indicated that people migrate to urban areas. In cities, people are facing poverty and change in diet and this affects affects peoples' health. Fruits protect people against cardio-vascular diseases and in cities, people are not able to afford some of these fruits. The presenter indicated that in Kinshasa, during April, a lot of rain is received and this excessive rainfall causes roads to be washed away due to erosion and the water is polluted resulting in disease outbreaks. The presenter also pointed out that poverty brings about hypertension.

## 9.10 Factoring Climate Information & Products into Water Resource Management: Prof F M Mutua

The presentation outlined the sources and distribution of freshwater in the world. The challenges in water resource management were described as:

**1 Variability**

- Water Resources variability
- rainfall, surface water and groundwater in the region are characterized by significant temporal and spatial variations resulting in difficulties in assessing the resource and local and seasonal shortages of adequate water resources
- Efforts to circumvent these problems have been hampered by
- Low reliability in climate variability forecasts, droughts, floods
- Low reliability in Climate change projections, desertification, sea-level rise and decrease in rainfall amounts and increasing frequency of extremes.

**2 Impact of Human Activities**

· The impact of population growth in the region, combined with increasing economic development has resulted in increased water demands, increased water pollution and over-reliance on surface water resources.

3 **Competing Water Demands**

· Competition for the locally scarce water resources is an increasing problem at all levels throughout the region, from small communities to large river basins.

The presentation outlined the following recommendations:

· Changes in the Approach;
· Intensity in Research on Assessment and Variability;
· Promotion of Self-dependence, and
· Improvement in economies and Incomes.

## 9.11 Discussion

The participants raised a number of questions regarding the RANET presentation. They wanted to know the meaning of 'RANET' and why the water and sanitation institutions were not among the organizations presented to be participating in the RANET project. There were also questions on the source of funding for RANET, how sustainable the funding was and if the RANET process was actually cheaper than the existing methods of communicating information. In response, the presenter of the paper said that RANET is an acronym for Radio and Internet Connection to Rural Areas. The presenter also responded that with the regard to taking on board the people from water and sanitation, the Ministry of Rural Development and Community have been taken on board and are involved in passing the information to the people. With regard to funding, the presenter indicated that funding was indeed a problem, however, the government was getting information on how well the project could be run with the communities being fully responsible. The presenter also indicated that the communities are very determined to get the project going, are fully aware of the financial implications, and are willing to run the project and make a contribution.

Participants commended the presentation on “Factoring climate information in water resources management”.

Following the presentation on “Using seasonal outlook to mitigate impacts of adverse climate conditions on rural small-scale farmers in selected communities in South Africa”, participants wanted to know the criteria that was used to define small-scale farmers and they also wanted to know how the farmers were selected to be involved in the research project. They also wanted to know if the Extension Officers were also involved in modeling as well as in the data capture. In response, the presenter said that small-scale farmers have particular types of farm sizes which are relatively small. Extension Officers were involved in the selection of farmers involved in the research project on the basis of personal interest by the farmers.

Following the presentation on “The use of climate information in health services in the Congo (DRC)” participants wanted to know how the rain influences certain diseases

since it rains most of the time in the DRC. The presenter responded by saying that diet is related to seasons and in Africa, the rainy season is the season that give the people food. The presenter indicated that in Kinshasa, in the month of April, a lot of rain is received and this excessive rainfall causes roads to be washed away due to erosion and the water is polluted resulting in several disease outbreaks. The presenter also pointed out that poverty brings about hypertension.

There was a comment from a participant from DRC correcting the wrong impression about rainfall being experienced all the time. He said that it does not rain all the time in the DRC. There are places where a dry season is experienced. In Kinshasa, there is a four-month dry season. In Lubumbashi, there are eight months of the dry season. It is only around the equator that it rains most of the time and not the rest of the country.

The Drought Monitoring Centre said that issues of health should be looked at in totality. There are also issues of diet, which affect the health of an individual and there are climatic factors that affect or have an influence on the spread of diseases.

# 10. PROJECTS

## 10.1 Concepts of Pilot Projects: B Garan'anga, DMCH

- The projects are funded by the National Oceanic and Atmospheric Administration, Office of Global Programs (NOAA/OGP), USAID and the World Bank;
- Funds per project range from 1000 to 2000 US$;
- Project themes must address the use of climatic information in various sectors;
- Guidelines and application forms are available at the DMCH;
- Collaborative projects between meteorologists and users of seasonal weather forecasts are encouraged;
- Project proposals undergo a rigorous selection process involving the funding agencies;
- Processing of applications takes a short while but this depends on availability of funds;
- The implementation period of each project id 12 – 18 months.
- The applicants are required to contribute 10 – 20% of the cost of the project in kind.
- Projects that are not funded are referred back to the applicants for improvement and resubmission;
- Deadline for submission of application will be issued by DMCH.

## 10.2 Study of the Southern Province Early Warning and Monitoring Systems (Zambia): D H Nanja

The purpose of the study was to find out whether increased flow of meteorological information could help improve agricultural productivity.

**Methodology:**

- Three study areas were sampled;
- Information was supplied at different levels;
- Farmer communities were formed and each group was supplied with battery powered radio cassettes and blank cassette tapes;
- Each group selected two representatives;
- Meteorological radio programmes in vernacular were produced and disseminated using two radio stations;
- Brochures of meteorological information were produce in vernacular languages;
- Public sensitization meeting were held;
- Drama on radio and public meetings were used to disseminate meteorological information;
- Training workshops for extension staff and stakeholders were held;
- Farmers met once a week to replay the taped radio programmes.

**Observations:** From the baseline study the following observations were made:

| | | |
|---|---|---|
| Understanding of meteorological information | | 3.1% |
| Usage of meteorological information | | 5.3% |
| Meteorological inquiries | | 1.9% |
| Source of meteorological information: | Radio | 4.3% |
| | Literature | 5.7% |
| | Friends | 11.4% |

**Project Analysis**

- Results could not be linked to yield due to timing of project exercusion;
- Official launching of the project brought national awareness;
- Radio supplies increased accessibility to broadcast meteorological information;
- Public meeting and linkages with partners provided immediate related answers;
- Farmer participation on radio increased farmers confidence;
- Use of dram was the most effective method;
- Use of music added value;
- The involvement of local leadership increased the attendance to meetings;
- Community understanding of meteorological information increased tremendously;
- Improved understanding and usage of meteorological information is expected to result in increased agricultural productivity.

# 11. RECOMMENDATIONS AND CONCLUSIONS

## 11.1 Future Perspectives of SARCOF: E Poolmann

### 11.1.1 SARCOF PROCESS

a. Backdrop

i. Review of Regional Climate Outlook Forum (RCOF) - Oct 2000

Pretoria
ii. Other investigations

b. Process investigation
   i. Definition of Framework of entire process
   ii. Develop & implement a strategic plan
   iii. Special intervention to address forum sustainability

### 11.1.2 WHY SPECIAL INTERVENTION?

a. Current SARCOF is funded by DMC project funds - BUT no funds are available for next pre-season meeting!
b. Donors warned that funds for future RCOFs are not secured
c. Need to ensure that the next SARCOF can take place

### 11.1.3 CURRENT SCENARIO

a. Background:
   i. RCOF Started in 1997 in Kadoma, Zimbabwe
   ii. First RCOF in the world, model for others
b. Primarily based around two forums
   i. September pre-season meeting
   ii. December update meeting
   iii. Capacity building workshops preceding forums
c. Funding
   i. EU, Worldbank, NOAA and lately DMC project

### 11.1.4 Main Benefits of SARCOF

i. Biggest success story in regional meteorology
ii. Coordinated consensus seasonal forecast
iii. Fostered forecaster/user interaction
iv. Capacity building in SADC NMSs
v. Shifted initiative towards SADC countries, with NMSs largely at centre of functions
vi. Increased the visibility of the climate
vii. Developed user interest

### 11.1.5 Problems Facing SARCOF

i. Sustainability of Forum
ii. Funding of Forum
iii. Too much emphasis on forum, not yet a continuous process throughout the year
iv. National forecasting activities need more development
v. Tailoring of products towards user needs still not addressed satisfactorily

vi. Not yet enough recognition in official SADC political structures

### 11.1.6 Proposed Framework for Process

a. RCOF Vision is a continuous process through year
   i. Regional structure plays largely a coordination role supporting NMSs
   ii. Focus on NMSs as main points of forecast production and user interaction
   iii. Regular monthly updates of national and regional forecasts
   iv. Increased forming of multidisciplinary partnerships
   v. Regular NMS/user updating on developments
   vi. Regular networking of forecasters through year
b. A strategy is currently under development

### 11.1.7 Proposed 3-Tiered Process around Forum

a. Countries prepare country consensus forecasts at home
b. Capacity building workshop 1 week prior to forum:
   i. Attended by trained forecasters from each country
   ii. Updating of forecasters skills, training new techniques
   iii. Development of regional consensus forecast

c. Followed by 3 day pre-season Forum:
   i. To foster user/scientist interaction
   ii. To discuss regional consensus forecast and its implications
   iii. To discuss, test, and promote new methodologies in forecasting or user applications
d. Separate forecaster training workshops during year

### 11.1.8 Funding Aspects

a. 1 week Pre-season capacity building workshop
   i. Funded through DMC process, also with in-kind contribution by NMSs
b. 3 Day SARCOF Forum
   i. Conference administration funded through regional available funds
   ii. Users and Scientists to fund their own participation
   iii. Sponsorships sourced by local organizers where possible
c. Separate forecaster training workshops
   i. Funded through regional acquired funds

### 11.1.9 The Scene for 2002 - the Opportunity

a. Big event: The Johannesburg World Summit (Rio+10, or WSSD) in September 2002

b. SASAS Conference in Pretoria in September
c. Proposed SARCOF in Pretoria in September
   i. Held back-to-back with SASAS
   ii. Theme focus on Impact of Climate Change on seasonal climate, to tie into WSSD
   iii. Ideal opportunity since both SARCOF & SASAS can benefit from high profile of WSSD
   iv. Will draw attention to weather & seasonal climate issues

## 11.2 Answers to the Users' Recommendation from SARCOF 4: Dr B Nyenzi, DMCH

During the Fourth SARCOF held in Gaborone, Botswana, during September 2000, the user community made some recommendations regarding interactions and contents of Seasonal Climate Outlooks. Below is a summary of the main recommendations and some responses from the DMCH:

A Users emphasized the need for interaction between generators of products and the various users in different sectors of the economy so as to enhance capacity building among the stakeholders through user-education, training workshops and pilot projects.
- Effort is being made to ensure that users from various sectors attend the SARCOF meetings which have a two day session devoted to users needs;
- The pilot projects also help in assessing the user needs and benefits from the long lead predictions and information.

B Users want products tailored to sectoral user needs.
- Arrangement has been made to have workshops/bulletins, on sectoral tailored forecasts, after SARCOF5.

C Users do not fully understand probabilistic forecasts and some of the terminology used in interpreting seasonal forecasts.
- At the moment, probabilistic forecasts seem to be better for the dissemination of information. The DMC in collaboration with other centres is working hard to improve the terminology used in forecasts. However, suggestions are still welcome.

D Users expressed the need for DMC to update seasonal forecasts on a monthly basis, and post them on the DMC website. On the other hand, users wanted to know who prepares the updates, whether it the DMC or the NMHSs.
- The DMC has established a website. Seasonal updates on monthly basis are posted on the site. Some NMHSs are also updating their national seasonal forecasts.
- The DMC website address is: www.dmc.co.zw
- Email address is: dmcgen@dmc.co.zw

E Users proposed the provision of information on the onset and cessation of the rains, including spatial and temporal distribution of rainfall.

- At regional level, this is being done at DMC. A consultant carried out a study on the variability of rainfall. The results of this study are very useful on these aspects.
- At national level, it is the responsibility of the NMSs, but some of them do not have the capacity to carry out these studies.

F Users would like the seasonal climate outlook to include temperature forecasts. They would also like the SARCOF process to explore the possibility of integrating traditional indicators into the formulation of seasonal weather forecasts.

- There are problems of provision of data to the DMC by participating countries. This mitigates against the building of the necessary climatology for the purpose of developing correlation statistics. On the integration of traditional indictors into forecasts, work is in progress in pilot projects.

G Users felt that seasonal forecasts were too general and not quantitative enough. There is a need to downscale them to sub-county level, in order to make forecasts relevant to smaller areas.

- The Seasonal forecasts are general and not quantitative enough because they are tailored for all sectors. Sectors should define their specific requirements. Downscaling into smaller areas is being done since forecasts are prepared to Country level and later sub-divided into regions in each Country.

### 11.3 Users' Recommendations

(i) There should be an Improved Educational Awareness on how the formulation and interpretation of long lead forecast;

(ii) The DMC should be a repository for short range forecasts from different countries;

(iii) High, medium and low rainfall terciles for long rang forecasts should be quantified;

(iv) More exposure of media personnel to the field of climatology and increased availability of Met Officers for interviews as and when need arises;

(v) Improvement of information dissemination and communication of seasonal climate forecasts(SCF);

(vi) Strengthening of feedback mechanisms between NMHSs and users so as to improve the confidence of users in NMHSs products;

(vii) Updates of seasonal forecast should be made at the earliest possible time;

(viii) An up to date Regional Climate Information Centre should be established at the DMC for easy access by users;

(ix) A Regional Early Warning System should be established;

(x) The applications desk at the DMC should be strengthened so as to address sector applications needs, e.g. Agromet for Agriculture, Hydrology for the Water Sector;

(xi) The lead-time of the SCF should be increased and the SCF should include information on the onset of the rains, distribution of the rainfall and prospects of the mid-season dry spells;

(xii) The seasonal climate outlook should provide long lead temperature forecasts;

(xiii) The NMHSs should collaborate with the Malaria Control Programmes in order to enhance the application of Seasonal Climate Information by the sector.

The users were not happy that the Meteorologists were absent during their discussions

### 11.4 Recommendations from the Capacity Building Workshop Meteorologists

- The duration of the capacity building workshop was too short;
- More computers should be provided for the workshop;
- The number of instructors should be increased.

### 11.5 The World Health Organization's Malaria Forecast for the 2001/2002 Season: D Shambare

The representatives of the World Health Organization (WHO) and the Health Sector downscaled the Seasonal Climate Outlook for the 2001/2002 rainfall season for their needs. Thereafter they produced a temperature and malaria forecast for the forthcoming season over the SADC region.

**Temperature Forecast**

Normal to above normal temperatures are expected in the region up to January 2002.

**Malaria Forecasts:**

**Regional Malaria Forecasts**

The malaria sub-regional forecasts were based mainly on rainfall forecasts and malaria transmission areas. **Country level district forecasts** should take into account more local variations in transmission risk areas, epidemic risk areas, past malaria trends and coverage of past and current malaria control interventions.

**Country Malaria Forecasts**

The representatives of the National Malaria Control Programmes produced some preliminary country level malaria forecasts which were going to be reviewed with their colleagues. The forecasts will be used to plan for malaria prevention and control activities for the 2001/2002 malaria season.

Maps of the regional and country-level malaria forecasts were presented.

# 12 CLOSURE OF THE FORUM

The deputy secretary in the Ministry of Transport and Public Works closed the Forum.

**APPENDIX A: Programme of the Forum**

**SOUTHERN AFRICA DROUGHT MONITORING CENTRE**

**HARARE, ZIMBABWE**

# SOUTHERN AFRICA REGIONAL CLIMATE OUTLOOK FORUM (SARCOF)

17-21 SEPTEMBER 2001, MANGOCHI, MALAWI

## DRAFT PROGRAMME

Monday, September 17, 2001

08.00 – 09.00 Registration

09.00 – 10.30 Official Opening

**10.30 – 11.00 Coffee/Tea Break**

**SESSION I: GENERAL CONCEPTS**

***Chairperson:*** *Mr. B. Sekoli* ***Rapporteur:*** *Mr B. Chipindu*

11:00-11:15 Forum perspectives: *Dr. B.S. Nyenzi -DMCH*

11:15-11:30 Contribution of regional climate system monitoring to climate related natural disaster management in Southern Africa: *Mr. B. Garanganga*

11.30-11.45 Perspectives of dynamical modelling of the seasonal forecast in Southern Africa: *Dr. H. Rautenbach*

11:45-12:00 Impacts of extreme weather and climate events on river flow and dams management: *(SADC Water sector)*

12.00-12.30 Potential impacts of climate forecast on malaria control with emphasis over Southern Africa*: (WHO-regional/country office)*

12.30-13.00 Discussion

**13.00-14.00 Lunch**

## SESSION II: GENERAL CLIMATE APPLICATIONS

***Chairperson:*** *Mr G. Munthali* ***Rapporteur:*** *Dr R. Mugara*

14:00-14.20 Further positive developments in framing climate prediction products in ways most effective in influencing planned socio-economic decision-making: *Mr. Majugu*

14:20-14:40 The role of agriculture extension workers in utilization of seasonal forecast: *Mr. D. Nyoni/D. Simela*

14:40-15:00 Promotion and integration of indigenous knowledge in seasonal climate forecasts: *Ms. M. Kingamkono*

15:00-15:20 Assessment of forecast use, communication and development of climate outlook scenarios for crop models: *Prof. Sue Walker*

15:20-15:50 Coffee/Tea Break

15:50-16:05 Economic benefit of applying seasonal climate forecast in hydropower management: *Mr. H. Sinyangwe/Kamanga*

16:05-16:20 Lessons and measures to mitigate flood Disaster/View of water sector in Mozambique: *Mr. B. M. Chivambo*

16:20-16:35 Economic benefits of applying seasonal climate forecasts for farm management in Zimbabwe: *Mr. R Mano*

16:35-16:50 Climate information for agricultural decision making for sustainable agricultural production and food Security in the SADC Region:
*Dr. E. Mukhala*

16:50-17:30 Discussion

***Tuesday September 18,2001***

**WORKING GROUP FOR COUNTRIES:**

08.00: 08.30 Preparation for the presentation on the experience of the 2000/2001 rainfall season by the countries

**SESSION III: REVIEW OF THE 2000/2001 RAINFALL SEASON**

***Chairperson**: Dr A. Makarau* ***Rapporteur:** Mr M Dlamini*

0845-0900 Review of the 2000/2001 rainfall season in West Africa: *ACMAD*

0900-0915 Review of the 2000/2001 rainfall season in Eastern Africa: *DMCN*

0915-0930 Review of the 2000/2001 rainfall season in Southern Africa: *DMCH*

0930-0945 Verification of the 2000/2001 SARCOF products: *Mr. Garanganga/Mr T. Marguerite*

0945-1000 Discussion

**10 30-1250 REVIEW OF THE SEASON FROM THE USERS' PERSPECTIVE BY COUNTRY**

Experience during the last season and lessons learnt by the users from the previous Climate Outlook Forum *(10 minutes per country)*:

| | | | | |
|---|---|---|---|---|
| Botswana | DRC | Lesotho | Malawi | Mozambique |
| Mauritius | Namibia | Seychelles | South Africa | Swaziland |
| Tanzania | Zambia, | Zimbabwe | | |

**1030-1250 PARALLEL SESSION FOR THE NATIONAL METEOROLOGICAL DIRECTORS TO DISCUSS THE STRATEGIC PLAN FOR DMCH**

12:50-13:00 Discussion

**13:00-14:00 Lunch**

**SESSION IV: FORECAST PRESENTATION**

***Chairperson**: Mr E. Mpeta* ***Rapporteur**: Mr J. Nkokwe*

1400-1415 Review of the current state of the global climate: Dr H Rautenbach

1415-1430 SST anomalies over the Indian Ocean and global climate model output results: DR C Risen

1430-1445 Rainfall predictors used in southern Africa**:** *B. Chipindu*

1445-1600 Presentation of October 2001 – March 2002 Climate Outlook by NMHS's *(5 minutes per country)*

**1600-1615 Coffee/Tea Break**

1615-1730 Forecast presentations by various Centres and Institutions: DMC-N *(Prof. L. Ogallo, COCA (Uni. of Pretoria), UKMO, IRI, ECMWF and DMCH (Mr B. Garanganga)*

1730-1800 Discussion

***Wednesday 19, 2001***

**WORKING GROUP FOR USERS AND CLIMATE SCIENTISTS**
**PARALLEL SESSION FOR USERS AND CLIMATE EXPERTS FROM 0830 to 1000**

**SESSION V: USERS' NEEDS**

***Chairperson:*** *Prof. S. Walker* ***Rapporteur:*** *D. Simela*

0830-0900 Constitution of sector teams: *(1) Energy & Water sector (2) Agriculture and Food security (3) health/WHO only (4) Environment and (5) Media sector.*

0900-1000 Sector teams meet to prepare for presentations

**1000-1030 Coffee/Tea break**

1030-1230 Sector Team presentations

1230-1300 Discussion

**13:00-14:00 Lunch**

**SESSION VI: CLIMATE OUTLOOK FORUM CONSENSUS DEVELOPMENT**

***Chairperson:*** *B Chipindu* ***Rapporteur:*** *Mr B. Garanganga*

0830-1000 Consensus development

1000-1030 Tea/Coffee Break

1030-1300 Preparation of draft consensus outlook statement (small drafting team continues even in the afternoon)

1300-1400 Lunch

**SESSION VII: DISCUSSION OF SARCOF PROCESS GROUP**

**SESSION VIII: DISSEMINATION OF CLIMATE FORECASTS**

***Chairperson:*** *Mr E. Dlamini* ***Rapporteur:*** *Mr E. Mukhala*

1400-1415 Exploiting climate prediction products in mitigating the potential negative impacts of extreme weather and climate events: *Mr. Majugu*

1415-1430 Towards a seasonal hydrological forecast: *K Asante*

1430-1445 Role of the media in dissemination of seasonal forecast: *Mr. E. Mrutu*

1445-1500 Users views and experiences on the ways the climate forecasts are disseminated: *Mr. Gidala*

1500-1515 Brief on RANET, Zambia experience: *Lt. Col. N'gambi*

1515-1530 Use of forecasts and other climate related data from the South African community/Agriculture: *Mr. C.P. Modika*

**1530-1600 Tea/Coffee break**

1610-1615 Using the Seasonal forecast for the small-scale farmer: *Dr. E. Mellaart*

1615-1630 The use of climate information in health services in the Congo (DRC): Prof L Mbenzi

1630 1645 Factoring climate information & products into water resource management: Prof F M Mutua

1630-1700 Discussion

***Thursday, September 20, 2001***

**SESSION IX: EDITING AND ADOPTION OF OUTLOOK STATEMENT**

***Chairperson****: B Chipindu* ***Rapporteur:*** *Mr. B. Garanganga/Mr J. Nkokwe*

830- 1030 Editing and adoption of consensus outlook statement by climate scientists

**1000- 1030 Coffee/Tea Break**

1030-1300 Drafting team presents the edited version of the outlook statement to NMHSs

**13:00-14:00 Lunch**

1400-1500 Presentation of the Consensus Outlook for the 2001-2002 rainfall season to plenary

**SESSION X: PROJECTS AND STRATEGIC PLAN**

***Chairperson:*** *Mr. V. Simango* ***Rapporteur:*** *:Mr . D. Nyoni*

1500-1515 Concepts of Pilot Projects: *B Garan'anga, DMCH*

1515-1545 Presentations on DMCH Pilot projects status: *D.H. Nanja*

1545-1600 Coffee/Tea Break

1600-1630 Presentation of the strategic plan for DMCH

1630-1700 Discussion

**Friday, September 21, 2001**

**SESSION XI: RECOMMENDATIONS AND CONCLUSIONS**

***Chairperson:*** *Mr. V. Simango* ***Rapporteur:*** *Mr B. Chipindu/Mr B. Garanganga*

0840- 0915 Future perspective of SARCOF: *Eugene Poolman*

0916- 0924 Answers to the users' recommendations from SARCOF4.

0924- 0927 User's recommendations

0927- 0930 Capacity building Meteorologists' recommendations of the Forum

0930-1000 WHO malaria forecast for the 2001/2002 season: D Shambare

**1000-1030 Coffee/Tea break**

1030-1130 CLOSING CEREMONY

1130-1200 PRESS CONFERENCE

1200-1400 Lunch

# APPENDIX B: SPEECHES MADE DURING THE OPENING CEREMONY

## B1 SPEECH MADE BY THE MINISTER OF TRANSPORT & PUBLIC WORKS, KALIYOMA PHUMISA, ON THE OCCASION OF THE OFFICIAL OPENING OF THE FIFTH SOUTHERN AFRICA REGIONAL CLIMATE OUTLOOK FORUM (SARCOF 5), MANGOCHI, MALAWI, 17 – 21 SEPTEMBER 2001.

## B2 REMARKS BY THE SECRETARY FOR TRANSPORT & PUBLIC WORKS, MR ALEX GOMANI

## B3 REMARKS BY MR V SIMANGO, REPRESENTATIVE OF THE WORLD METEOROLOGICAL ORGANIZATION (WMO)

Honorable Kaliyoma Phumisa, Minister of Transport and Public Works;
The Secretary for Transport and Public Works, Mr. Alex Gomani;
Mr. Donald Kamdonyo, the Director of Malawi Meteorology and Permanent Representative of Malawi with WMO;
The Representative of SATCC;
Permanent Representatives of the SADC member countries with WMO;
Dr Kabineh Konneh the Representative of NOAA/OGP;
Coordinator of the DMC Harare
Distinguished Guests;
Forum participants;
Ladies and Gentlemen.

It gives me great pleasure to make a few remarks on the occasion of the official opening of the Fifth Southern Africa Regional Climate Outlook Forum (SARCOF 5). On behalf of the World Meteorological Organisation (WMO), I wish to express my sincere appreciation to the Government of Malawi for hosting this important forum. Once again within a period of two years after the SCOM on meteorology meeting for the Directors of the SADC NMHSs, this resort town of Mangochi is hosting on one the main activities of the DMC-Harare, SARCOF. This is a clear testimony of the commitment of the

Government of Malawi to promote the optimum application of climate information and products in support of sustainable development in Malawi and in the region as a whole.

I would like to take this opportunity to give special thanks to Mr. Kamdonyo, the Permanent Representative of Malawi with WMO and his staff for the kind hospitality and warm welcome that they have accorded to all of us, since our arrival in this friendly country. I wish to commend him and the organizers of the Forum for the excellent arrangements they have made for the meeting, which I believe will contribute to its successful conclusion.

**Honourable Minister,**

This forum is being organized by the Harare Drought Monitoring Centre under the auspices of the World Meteorological Organization (WMO). The funding of these initiatives are provided principally through the generous funds as Grant to SATCC from the Kingdom of Belgium. Additional resources are availed at the Center by the USAID through National Oceanic and Atmospheric Administration/Office of Global Programmes (NOAA/OGP). And I am informed that the International Research Institute for Climate Prediction (IRI), realizing the importance of the work of the DMC in the subregion, have expressed an interest to fund part of the activities of the DMC in order to strengthen and broaden its activities.

The pre-forum Capacity Building Workshop for regional climate scientists that was completed on Saturday last week in Harare, Zimbabwe, was also organized under the framework of the project AAA 6.02. I wish to express WMO's gratitude to the Kingdom of Belgium, the World Bank and USAID for their assistance that has proved so fundamental to the continued operations and improved functioning of the DMC. A special word of appreciation also goes to NOAA/OGP for supporting several users workshops and pilot application projects that are being implemented within the framework of the DMC's activities. It is also to be recalled that most of the users at this forum are being supported by funds provided by NOAA/OGP.

**Distinguished Guests,**
**Forum participants,**
**Ladies and Gentlemen**

Extreme climate events such as droughts and floods have in the recent past afflicted this region, often with devastating consequences in terms of economic disruption, poverty, among many others. Because these events are recurrent in nature, effective, accurate and timely prediction and early warning of these events can enable Governments and stakeholders to put into motion appropriate actions for mitigating or alleviating their adverse impacts. It is within this context, that the World Meteorological Organization, in 1989 established the two Drought Monitoring Centres in Harare, Zimbabwe and Nairobi, Kenya with the support of UNDP. Furthermore, in 1997, WMO established the Climate Information and Prediction Services Project (CLIPS) with the view to supporting Member countries to optimize the use of climate information and prediction products. It is within this context that WMO and many other partners has organized many climate outlook forums in

many other parts of the world. Output products from these forums have been used to enhance preparedness and mitigation efforts in many countries and have also been useful to planners and decision makers in the implementation of many programmes and activities that are weather sensitive in nature.

In the SADC region, the Harare Drought Monitoring Centre and the individual National Meteorological and Hydrological Services have played a major role in providing weather and climate advisories, including advance warnings on the likelihood of droughts, floods and other extreme weather events.

## Distinguished Guests, Ladies and Gentlemen

The objective of this forum is to make a consensus seasonal rainfall forecast for the October 2001 to March 2002 rainfall season and to discuss its potential impacts on socio-economic activities in this sub-region. I am, therefore, heartened to see many potential users of these forecasts present here today. I would like to urge them to interact actively in the deliberations of the forum and ensure that they understand the potential benefits that could be derived from applying the products from the forum.

**Honourable Minister,**

Since the first forum in Kadoma, Zimbabwe in September 1997, the SARCOF process has established itself as an effective mechanism for co-ordinating the generation, dissemination, interpretation and application of climate information and prediction products in the region. It has also served as a useful tool for assessing the effectiveness of these forecasts, and for translating lessons learnt into future corrective actions. The forums have also made positive contributions in mitigating the adverse impacts of extreme climate events in the region. The challenge before us, therefore, is to find ways of maintaining this process in the future because it is not sustainable in its present format due to the high costs involved. In the meantime, however, I would like to urge the SADC governments, relevant partners and other stakeholders to provide adequate support to NMHSs, as well as to the Harare Drought Monitoring Centre in order to ensure that these institutions continue to provide products and services necessary for sustainable development in the region.

In this regard, WMO applauds the recent decision by the SADC Heads of State to adopt the Harare DMC as part of specialised institutions of SADC. I would like to assure you that on its part, WMO will continue to provide the DMCH with the necessary scientific and technical support and guidance for its continued operations. WMO will also continue to work with its partners in the international community as well as Governments in order to ensure the sustainability of the DMCH and the NMHSs in the region.

In concluding, I would like once again to thank the Government of Malawi for its kind hospitality, and to wish the forum fruitful deliberations.

Thank you.

## B4 REMARKS BY THE COORDINATOR OF THE DROUGHT MONITORING CENTRE, HARARE, DR B S NYENZI

Honorable Kaliyoma Phumisa, Minister of Transport and Public Works;

The Representative of the Secretary General of WMO Mr. Victor Simango ;

The Secretary for Transport and Public Works, Mr. Alex Gomani;

**The Director of Malawi Meteorological Services and Permanent Representative of Malawi with WMO Mr. Kamdonyo;**

**The Directors of Meteorological Services in SADC Region present here;**

**Distinguished Guests and Participants**

The Drought Monitoring Centre Harare was established in 1991 with its main objective to contribute in minimizing negative impacts of weather and the climatic extremes on the socio-economic development of the SADC region. Since its inception, this has been achieved through various activities including the monitoring of near real-time climatic trends and generating long-range climate outlook products. This has also been achieved through training experts within the SADC region in climate prediction and information packaging. The climate outlook products generated are disseminated in a timely manner to the communities of the sub-region principally through the National Meteorological Services, regional organizations, relief and donor agencies, thereby affording greater opportunity to decision-makers for development of strategic plans especially in dealing with adverse climatic conditions hence the theme for this meeting **"Meteorological and Hydrological contributions to Early Warning, Preparedness and Natural Disaster Management in Southern Africa"**.

**Honourable Minister,** in 1997 a process called the Southern Africa Regional Climate Outlook Forum (SARCOF) began with the main objective to ensure that a consensus pre-season climate forecast for the SADC Member States is issued around the month of September before the rainfall season starts. This was in order that differences from individual forecast could be resolved before final issue to the end users. The products of this process have so far proved to be useful and helpful in national strategic planning for SADC Member States in response to expected weather conditions. The seasonal weather forecasts issued through this process have alerted the SADC Member States on the expected seasonal rainfall situation, thus enabling them to take precautionary measures well in advance before facing the impacts of extreme weather conditions. In the case where the forecast weather is favourable for socio-economic activities opportunities have been appropriately taken to advantage.

**Ladies and gentlemen**, the SARCOF process has also been used as a medium of building capacity in long–lead climate forecasting for National Meteorological Services in the region. Experts from National Meteorological Services have been involved in

workshops which are designed to introduce them to various forecasting techniques and methodologies for the benefit of the multi-sectoral end-user. Through these workshops the participants have been able to develop their national seasonal rainfall forecasts. These forecasts are a major input into the consensus pre-seasonal rainfall forecast issued through the SARCOF process. Before this forum today, a four-week capacity building workshop ended last week in Harare Zimbabwe. The results of this workshop will thus form a major input in the development of the seasonal rainfall consensus outlook by various experts from different national, sub-regional and international institutions attending this meeting.

**Ladies and gentlemen** it important to note that much of this process would have not been successfully achieved without the support received from the National Meteorological Services in the region, World Meteorological Organization (WMO) which is the DMCH program executing Agency, the Government of Belgium for providing funds to support the current activities of the Centre, the Government of Zimbabwe as the DMCH host country and other collaborating international institutions such as the UNDP, the World Bank, NOAA (OGP) and others. We thank them all for their continued support to the DMC on its endeavor to enhance the capability and capacity of the long-lead forecasters in National Meteorological Services, within the region.

It is also important to point out that the financial support from the Government of Belgium will be coming to an end in April 2002 after which other arrangement of funding need to be identified. It is also not clear how the current restructuring of SADC Secretariat and its institutions will affect the DMC programmes. It is our hope that a permanent solution will be found without disrupting the on going and planned activities of the Center.

With these few remarks, **Honourable Minister, ladies and gentlemen,** I would like to thank, the Malawi Meteorological Services and your Government for accepting to hosting this meeting. We, acknowledge the hard work involved in preparing for a meeting like this one. We are immensely grateful for these efforts.

**Thank you.**

# APPENDIX C: LIST OF PARTICIPANTS – SARCOF 5
# MANGOCHI, MALAWI 17-21 SEPTEMBER 2001

| COUNTRY | PARTICIPANT AND CONTACT | INSTITUTION |
|---|---|---|
| 1. Botswana | M Matlhaga<br>Botswana Meteorological Services<br>P.O. Box 10100, Gaborone<br>Tel: 267-356281/314176<br>Fax: 267-356282/311427<br>Email: mmatlhaga@gov.bw | Botswana Meteorological Services |
| 2. Botswana | Kentse Moakofhi<br>Community Health Services (Malaria Unit) P.Bag 00269, Gaborone<br>Tel:267-307146<br>Fax 267-306686<br>Email: moakofhi@info.bw | Community Health Services (Malaria Unit) |
| 3. Botswana | Mr. R. Radithupa<br>Botswana Meteorological Services<br>P.O. Box 10100, Gaborone<br>Tel: 267-356281/314176<br>Fax: 267-356282/311427<br>Email: tizzardaps@yahoo.com | Department of Meteorological Services |
| 4. DRC | Prof Longo Mbenza<br>University of Kinshasa<br>BP 783 Kinshasa XI<br>Tel: 243-9930906<br>Email: longobenza@caramail.com | University of Kinshasa |
| 5. DRC | N.D. Faka<br>Mettelsat<br>Route Matadi Binza Meteo<br>P.O. Box 4715, Kishasa II<br>Ngaliema, Kishas<br>Tel: 243-8803656<br>dfaka@hotmail.com<br>mettelsat@ic.cd | Mettelsat |
| 6. DRC | Mr Pakulu V. Amos<br>Mettelsat<br>Route Matadi Binza Meteo<br>P.O. Box 4715, Kishasa II<br>Ngaliema, Kishas<br>Tel: 243-8803656/8126158<br>Fax: 243-12-82213<br>mettelsat@ic.cd | Mettelsat |
| 7. Kenya | Dr Francis Mutua<br>Department of Meteorology<br>University of Nairobi<br>P.O. Box 30197 Nairobi<br>Tel: 254-2-577371<br>Fax: 254-2-577373<br>Email: fmutua@uonbi.ac.ke | University of Nairobi |

| | | |
|---|---|---|
| 8. Lesotho | Mr. B.T. Sekoli<br>Lesotho Meteorological Services<br>P.O. Box 14515<br>Maseru 100<br>Tel: 266-317250/325057<br>Fax: 350325/325057<br>Email: bulane@lesoff.co.za<br>Email: bsekoli@hotmail.com | Lesotho Meteorological Services |
| 9. Lesotho | Malinco Nkhasi<br>Mineworkers Development Agency<br>Private Bag A456, Maseru 100<br>Tel: 09266-324004<br>Fax: 09266-310406<br>Email: mnkhasi@mda.org.ls | Mineworkers Development Agency |
| 10. Lesotho | Violet Maraisane<br>Lesotho News Agency (LNA)<br>P.O. Box 36, Maseru<br>Tel: 09266-325317<br>Fax: 09266-326408<br>vmaraisane@yahoo.com | Lesotho News Agency |
| 11. Lesotho | Mr. Limomane Peshoane<br>Lesotho Meteorological Services<br>P.O. Box 14515<br>Maseru 100<br>Tel: 266-325057/324425/350732<br>Fax: 350325/325057<br>Email: bulane@lesoff.co.za<br>Email: peshoane@yahoo.com | Lesotho Meteorological Services |
| 12. Malawi | Mr. D.R. Kamdonyo<br>Meteorological Services<br>P.O. Box 2, Chileka<br>Tel: 265-692333<br>Fax: 265-692329<br>Email: malawimet@malawi.net | Meteorological Services |
| 13. Malawi | Mr. G. Munthali<br>Meteorological Services<br>P.O. Box 2, Chileka<br>Tel: 265-692333<br>Fax: 265-692329<br>Email: malawimet@malawi.net | Meteorological Services |
| 14. Malawi | Mr. J. Nkhokwe<br>Meteorological Services<br>P.O. Box 2, Chileka<br>Tel: 265-692333<br>Fax: 265-692329<br>Email: malawimet@malawi.net | Meteorological Services |
| 15. Malawi | Mr. D. Gondwe<br>Meteorological Services<br>P.O. Box 2, Chileka<br>Tel: 265-692333<br>Fax: 265-692329<br>Email: malawimet@malawi.net | Meteorological Services |

| | | |
|---|---|---|
| 16. Malawi | Mr. W. Chimwaza<br>Meteorological Services<br>P.O. Box 2, Chileka<br>Tel: 265-692333<br>Fax: 265-692329<br>Email: malawimet@malawi.net | Meteorological Services |
| 17. Malawi | Mr. P. Kumwenda<br>Meteorological Services<br>P.O. Box 48, Lumbadzi<br>Tel: 265-700162<br>Fax: 265-700162 | Meteorological Services |
| 18. Malawi | Mr. P. Jiva<br>Meteorological Services<br>P.O. Box 48 Lumbadzi<br>Tel: 265-700759/700488/700770<br>Fax: 265-700162 | Meteorological Services |
| 19. Malawi | Mr. N. Mwafulirwa<br>Meteorological Services<br>P.O. Box 48 Lumbadzi<br>Tel: 265-700759/700488/700770<br>Fax: 265-700162<br>Email: metlia@malawi.net | Meteorological Services |
| 20. Malawi | Mr. B.K. Mlenga<br>P.O. Box 60511<br>Blantyre 6<br>Tel: 265-624922<br>Email: mlenga_bk@sndp.org.mw | |
| 21. Malawi | Mr. D.K. Kwatani<br>Civil Aviation<br>Private Bag 322, Lilongwe 3<br>Tel: 265-770577<br>Fax: 265-774986<br>Email: aviation@malawi.net | Civil Aviation |
| 22. Malawi | Mr. L.Z. Phesele<br>Civil Aviation<br>Private Bag 322, Lilongwe 3<br>Tel: 265-770577<br>Fax: 265-774986<br>Email: aviation@malawi.net | Civil Aviation |
| 23. Malawi | Mr. B.W. Chisamile<br>Ministry of Transport and Public Works<br>Private Bag 316, Lilongwe 3<br>Tel: 265-789377<br>Fax: 265-788027 | Ministry of Transport and Public Works |
| 24. Malawi | Mr. W.P.C.Chipeta<br>Ministry of Water Development<br>Private Bag 390, Lilongwe 3<br>Tel: 265-770344<br>Fax: 265-773737<br>Email: hydrology@malawi.net | Ministry of Water Development |
| 25. Malawi | Mr. N.E.A. Malenga<br>Tea Research Foundation<br>P.O. Box 51, Mulanje<br>Tel: 265-462225/462238 | Tea Research Foundation |

| | | |
|---|---|---|
| 26. Malawi | Mr. S.E.C. Nyoni<br>Department of Animal Health and Industry<br>(DAHI)<br>P.O. Box 2096, Lilongwe<br>Tel: 265-750455 | Department of Animal Health and Industry<br>(DAHI) |
| 27. Malawi | Mr. O.B. Liyawo<br>Malawi Broadcasting Coorporation (MBC)<br>P.O. Box 30133, Blantyre 3<br>Tel: 265-671222<br>Fax: 265-671353 | Malawi Broadcasting Coorporation<br>(MBC) |
| 28. Malawi | Mr. M.H. Selemani<br>Blantyre Water Board<br>P.O. Box 30369, Chichiri Blantyre 3<br>Tel: 265-67200<br>Email: mselemani@bwb.mw | Blantyre Water Board |
| 29. Malawi | Mr. B.W. Gidala<br>Disaster Preparedness Relief and Rehabilitation<br>Private Bag 336, Lilongwe 3<br>Tel: 265-789198/789188/942286<br>Fax: 789142<br>Email: relief@sndp.org.mw | Disaster Preparedness Relief and Rehabilitation |
| 30. Malawi | Mr. H.B. Mulilima<br>Marine Department<br>Private Bag A81, Lilongwe<br>Tel: 265-52666/755546/758894<br>Fax: 265-756290<br>Email: marinedepartment@malawi.net | Marine Department |
| 31. Malawi | Dr. A.T. Daudi<br>Ministry of Agriculture and Irrigation<br>Department of Agricultural Research and Technical Services<br>P.O. Box 30779, Lilongwe 3<br>Tel: 265-789033/788778<br>Fax: 265-788801<br>Email: agric-research@sdnp.org.mw<br>Email: pesticideboard@malawi.net | Ministry of Agriculture and Irrigation,<br>Department of Agricultural Research and Technical Services |
| 32 Malawi | Mr. J.A. Chiphwanya<br>National Malawi Control Programme<br>Private Bag 65, Lilongwe<br>Tel:265-752450/873136<br>Fax: 265-756828<br>Email: jchiphwanya@nmcpmw.malawi.net | National Malawi Control Programme |
| 33. Malawi | Mr. S.J. Banda<br>ADMARC<br>P.O. Box 5052, Limbe<br>Tel:265-640044<br>Email: admarc@malawi.net | ADMARC |
| 34. Malawi | Mr. W.L. Mandala<br>Agricultural Research and Extension Trust (ARET)<br>Private Bag 9, Lilongwe<br>Tel:265-761157<br>Fax: 265-761615<br>Email: aretkandiya@malawi.net | Agricultural Research and Extension Trust (ARET) |

| | | |
|---|---|---|
| 35. Malawi | Dr A.S. Kumwenda<br>Agricultural Research and Extension Trust (ARET)<br>Private Bag 9, Lilongwe<br>Tel:265-761157<br>Fax: 265-761615<br>Email: aret@malawi.net | Agricultural Research and Extension Trust<br>(ARET) |
| 36. Malawi | Mr K.J. Gondwe<br>Environment Affairs Department<br>Private Bag 394, Lilongwe<br>Tel: 265-773660<br>Fax: 265-773379<br>Email: cchauge@malawi.net | Environment Affairs Department |
| 37. Malawi | Mr. H.E. Dandaula<br>Environment Affairs Department<br>Private Bag 394, Lilongwe<br>Tel: 265-773660<br>Fax: 265-773379<br>Email: cchauge@malawi.net | Environment Affairs Department |
| 38. Mauritius | Mr. Rajan Mungra<br>Mauritius Meteorogical Service<br>St. Paul Road, Vacoas<br>Tel: 230-6861031/2<br>Fax: 230-6861033<br>Email: meteo@int. | Mauritius Meteorological Services |
| 39. Mozambique | Dr Ivone Rungo<br>NS-DEE-Seccao da malaria<br>C.P. 264, Maputo, Mozambique<br>Tel: 258-1-430970 | NS-DEE-Seccao da malaria |
| 40. Mozambique | Marcelino Eurico de Sales Lucas<br>Ministry of Health<br>Av. Salvador Aiende,<br>P.O. Box 264 Maputo<br>Tel: 258-1-310281<br>Fax: 258-426164 | Ministry of Health |
| 41. Mozambique | M.V. Benessene<br>Instituto Nacional de Meteorologia (INAM)<br>P.O. Box 597, INAM, Beira<br>Tel: 258-03-302360<br>Fax: 258-03-302360<br>Email: mbenessene@hotmail.com | Instituto Nacional de Meteorologia<br>(INAM) |
| 42. Mozambique | Mr. Jacinto Chai Chai,<br>Institute de Mass Communications<br>Av Amilcar Cabral, 214, Maputo<br>Tel:258-1-422524 Fax:258-1-430951 | Institute of Mass Communications |
| 43. Mozambique | Mr. A.Miguel Tembe<br>Radio Mozambique, P.O. Box 2000<br>Maputo.<br>Tel:258-1-777048<br>Email: tembeant@zipmail.com.mz | Radio Mozambique |
| 44. Mozambique | Manuel Afonso Maxlhaieie<br>National Institute for Disaster Management<br>Rua da Resistencia 1746 8th Floor<br>Tel 258-1-416007/8<br>Fax 258-1-417576<br>Email: ingc@teledata.mz | National Institute for Disaster Management |

| | | |
|---|---|---|
| 45. Mozambique | Mr V.C. Munguambe<br>South Region Water Authority<br>Av Samora Machel, No. 30, 7$^{0}$ Andar, Maputo<br>Tel: 258-1-306729/30/455773<br>Fax: 258-1-306756<br>e-mail:arasul@zebra.uem.mz | South Region Water Authority |
| 46. Mozambique | Mr. B. Manuel Chivambo<br>National Department of Water Affairs<br>Av. 25 de Sitemtro 942-7$^{0}$ Andar,<br>Tel:258-1-300315 Fax:300316<br>Email: Chivambo_chives@hotmail.com<br>Email: ecommission@teledata.mz | National Department of Water Affairs |
| 47. Mozambique | Mr. Raul Cumba<br>NEWU,<br>Ministry of Agriculture & Rural Development,<br>Maputo<br>Tel: 258-1-460008/460191<br>Fax: 258-1-460008<br>e-mail: rcumba@map.gov.mz | Ministry of Agriculture & Rural Development |
| 48. Mozambique | Mr. Silvano Langa<br>INGC National Institute for Disaster Management<br>Rua da Resistencia 1746 8$^{0}$ Andar<br>Tel 258 1 417577<br>Fax 258 1 417576<br>Email: ingcdn@teledata.mz | INGC National Institute for Disaster Management |
| 49. Mozambique | Mr. Joao Pedro Fumo<br>Socedade Do Noticias-Sarl<br>Rua Joaqvim LaPa No. 55<br>P.O. Box 327, Maputo<br>Tel:258-1-423136/422815<br>Fax:258-1-423136/420575<br>e-mail: fumojoao@hotmail.com | Noticias Newspaper |
| 50. Mozambique | Mr. Faustino Igreja<br>Radio Mozambique EP<br>P.O. Box 2000, Maputo<br>Tel: 258-1-429908<br>Fax: 258-1-429826 | Radio Mozambique EP |
| 51. Namibia | Mr. E.N.Z. Kambueza<br>Namibia Meteorological Service<br>P.O. Box 4394, Windhoek<br>Tel: 264-61-2082179<br>Fax: 264-61-2082197<br>Email: weather@iafrica.com.na | Namibia Meteorological Service |
| 52. Namibia | Mr. Simon A. Dirkse<br>Namibia Meteorological Service<br>Private Bag 13224, Windhoek<br>Tel: 264-61-2082169<br>Fax: 264-61-2082197<br>Email: weather@iafrica.com.na<br>Email: dirkse2020@yahoo.co.uk | Namibia Meteorological Service |
| 53. Namibia | Dr P. Uusiku<br>Ministry of Health and Social Services,<br>P. Bag 13198 Windhoek<br>Tel: 264 612 032 309<br>Email: vecont@iafrica.com.na | Ministry of Health and Social Services |

| | | |
|---|---|---|
| 54. Seychelles | T. Marguerite<br>Seychelles Meteorological Services<br>C/o Ministry of Environment and Transport<br>Botanical Gardens<br>Mont ……<br>Tel: 248-384070/66/65<br>Fax: 248-384078<br>Email: tmarguerite@hotmail.com | Seychelles Meteorological Services |
| 55. South Africa | Mr. E. Poolman<br>South Africa Weather Service<br>Private Bag X097<br>Pretoria, 0001<br>Tel: 27-12-3093086<br>Fax: 27-12-3234518<br>poolman@weathersa.co.za | South Africa Weather Service |
| 56. South Africa | Mr. M.S. Mugeri<br>South African Weather Service<br>Private Bag X097<br>Pretoria, 0001<br>Tel: 27-12-3093346<br>Fax: 27-12-3234518<br>Email: melton@weathersa.co.za | South African Weather Service |
| 57. South Africa | Mr. I. B. Kgakatsi<br>South African Weather Service<br>Private Bag X097<br>Pretoria, 0001<br>Tel: 27-12-3093086<br>Fax: 27-12-3234518<br>Email: kgakatsi@weathersa.co.za | South African Weather Service |
| 58. South Africa | Mr.T.V. Mugogovhali<br>Department of Agriculture<br>P.O. Box 1721, Thohoyandu, 0950<br>Northern Province<br>Tel: 27-159632004/5/0825055123<br>Fx:27 159631414 | Dept of Agriculture |
| 59. South Africa | Mr. C. P Modika<br>Dept of Agriculture, Conservation & Environment<br>Private Bag X804, Potchefstroom, 2520<br>Tel: 27-0182996723 Fax 27-0182977135<br>e-mail: giscpm@potchl.agric.co.za | Dept of Agriculture, Conservation & Environment |
| 60. South Africa | Mr D. Moonsar<br>National Department of Health<br>P. Bag X88, Pretoria 0001<br>Tel: 27-12-3120102<br>Fax: 27-12-3238626<br>Email: moonad@health.gov.za | National Department of Health |
| 61. South Africa | Prof. Sue Walker<br>The University of the OFS<br>Department of Agrometeorology<br>Faculty of Agriculture,<br>P.O. Box 339 Bloemfontein 9300<br>Tel:27-51-4012222<br>Fax27-51-4480692<br>Email: walkers@sci.uovs.ac.za | The University of the Orange Free State |

| | | |
|---|---|---|
| 62. South Africa | Dr E. Mellaart<br>Agricultural Research. Council,<br>(ARC-ISCW)<br>Private Bag X11208<br>Nelspruit 1200<br>Tel:27-13-7532071<br>Fax: 27-13-7523854<br>email eduard.mellaart@itsc.agric.za<br>email: iscw@igkw2.agric.za | Agricultural Research Council<br>(ARC-ISCW) |
| 63. South Africa | Mr. S.J. Kgalake<br>National Department of Agriculture<br>Private Bag X 250, Pretoria 0001<br>Tel:27-12-3196748/3196711<br>e-mail: jankg@nda.agric.za | National Department of<br>Agriculture |
| 64. South Africa | R.F. Phaladi<br>National Department of Agriculture<br>Private Bag X250, Pretoria<br>Tel:27-12-3196668/3196711<br>Fax: 27-12-3196711<br>e-mail:MahlatseP@nda.agric.za | National Department of<br>Agriculture |
| 65. South Africa | Mr. Hannes Rautenbach<br>University of Pretoria<br>P.O. Box 2351, Wingate Park 0153<br>Pretoria 0002<br>Tel: 27 12 4202173<br>Fax 27 17 3625219<br>Email: hrautenb@postino.up.ac.za | University of Pretoria |
| 66. South Africa | Dr Chris Reason<br>EGS and Oceanography Department, University of<br>Cape Town,<br>P. Bag BA6<br>Rondebosch 7701<br>Tel: 27-21-650-4117<br>Fax: 27-21-650-3791<br>Email: cjr@egs.uct.ac.za | Department of EGS and<br>Oceanography |
| 67. Swaziland | Mr E. D. Dlamini<br>National Meteorological Service<br>P.O. Box 58<br>Mbabane<br>Tel:268-40-48859<br>Tel:268-40-41530<br>Email: ed_dlamini@realnet.co.sz | National Meteorological Service |
| 68. Swaziland | Mr. Mandla A. Dlamini<br>National Meteorological Service<br>P.O. Box 58<br>Mbabane<br>Tel:268-40-46274<br>Fax: 268-40-41530<br>Email: ma_dlamini@swazimet.gov.sz | National Meteorological Service |

| | | |
|---|---|---|
| 69. Swaziland | Mr Quinton Dlamini<br>Ministry of Health (NMCP)<br>P.O. Box 53<br>Manzini<br>Tel: 268-5052041/2<br>Fax: 268-5057882<br>Email: malaria@iafrica.com | Ministry of Health (NMCP) |
| 70. Swaziland | Mr. Sidney M. Dlamini<br>Water Resources Branch<br>Tel: 268-40-42061<br>Fax: 268-40-42019 | Water Resources Branch |
| 71. Swaziland | Mr. Qedusizi E. Ndlovu<br>Radio Swaziland<br>P.O. Box 338<br>Mbabane<br>Tel: 268-40-46953<br>Fax: 268-40-45506 | Radio Swaziland |
| 72. Tanzania | Mr. Ernest Mrutu<br>School of Journalism<br>P.O. Box 4067<br>Dar-es-Salaam<br>Tel: 255-22-700236/741612431<br>Emrutu2001@yahoo.co.uk | |
| 73. Tanzania | Mrs M.M.N. Mhali<br>Ilala Municipality<br>Dar-es-Salaam<br>Agricultural and Livestock Office<br>P.O. Box 1253, Dar-es-Salaam,<br>Tel: 255-22-2121488 | Agriculture & Livestock Dev. Office |
| 74. Tanzania | Mrs. Margaret M. Kingamkono<br>Seliani Agricultural Research Insititute (SARI)<br>P.O. Box 6024<br>Arusha<br>Tel: 255-272503883<br>Fax: 255-272508557/3146<br>Email:mkingamkono@sari.co.tz<br>Email: margekingamkono@hotmail.com | Seliani Agricultural Research Institute (SARI) |
| 75. Tanzania | Mr. A.J. Mlaki<br>Tanzania Meteorological Agency<br>P.O. Box 3056<br>Dar-es-Salaam<br>Tel: 255-22-2844438/2110231/2110227<br>Fax:255-22-2110231<br>Mobile: 255-741414464<br>Email: **amlaki@hotmail.com** | Tanzania Meteorological Agency |
| 76. Tanzania | Mr. E.J. Mpeta<br>Tanzania Meteorological Agency<br>P.O. Box 3056<br>Dar-es-Salaam<br>Tel: 255-22-2110227/2110227<br>Fax: 255-22-2110231<br>Email: empeta@yahoo.co.uk<br>Email: met@meteo.org.tz | Tanzania Meteorological Services |

| | | |
|---|---|---|
| 77. Uganda | A.W. Majugu<br>Department of Meteorology<br>P.O Box 7025, Kampala<br>Tel: 256-41-233559<br>Fax: 256-41-51797<br>Email:abushen_majugu@hotmail.com | |
| 78. Zambia | Dr. R. Mugara<br>Zambia Meteorological Department<br>P.O. Box 30200, Lusaka<br>Tel: 260-1-252728<br>Fax: 260-1-252728/251889<br>Email: zmd@zamnet.zm | Department of Meteorological Department |
| 79. Zambia | Ms Y.P. Mwape<br>Disaster Management and Mitigation Unit (DMMU) – OVP<br>P.O. Box 38963, Lusaka<br>Tel: 260-1-253142/252692<br>Fax: 260-1-255725<br>email: dmmu@zamtel.zm<br>yandemwape@netscape.net | Disaster Management and Mitigation Unit (DMMU) |
| 80. Zambia | Mr. Durton H. Nanja<br>Zambia Meteorological Department<br>P.O Box 60004, Livingstone<br>Tel: 260-3-321256<br>Fax: 260-3-324235<br>Email: dnanja@yahoo.com | Zambia Meteorological Department |
| 81. Zambia | Mr. Manulula Mate<br>Zambia Meteorological Department<br>P.O Box 60004, Livingstone<br>Tel: 260-3-321256<br>Fax: 260-3-324235<br>Email: mate_mu@yahoo.co.uk<br>Email: zmd@zamnet.zm | Zambia Meteorological Department |
| 82. Zambia | Lt. Col. Davies Ng'ambi<br>Zambia Meteorological Department<br>P.O Box 30200, Lusaka<br>Email: zmd@zamnet.zm | RANET Project |
| 83. Zambia | Mr H.M Sinyangwe<br>ZESCO Ltd<br>P.O. Box 33304, Lusaka<br>Tel: 260-1-229542<br>Fax: 260-1-229542<br>Email: hsinyangwe@hotmail.com | ZESCO Ltd |
| 84. Zambia | Mr W Kapelwa<br>National Malaria Control Centre<br>P.O. Box 32509, Lusaka<br>Tel: 260-1-282455<br>Fax: 260-1-282427<br>Email: malaria@zamnet.zm | National Malaria Control Centre |

| | | |
|---|---|---|
| 85. Zambia | Mr E.M Siyamachoka<br>Zambezi River Authority<br>P.O. Box 30233, Lusaka<br>Tel:260-1-228401/236601<br>Fax:260-1-227498<br>Email: siamachoka@zaraho.org.zm<br>Email: zaraho@zamnet.zm | Zambezi River Authority |
| 86. Zimbabwe | Mr. Kampion Shoko<br>Zimbabwe Meteorological Services<br>P.O. Box BE 150, Belvere, Harare<br>Tel: 263-4-778160<br>Fax: 263-4-778161<br>Email: shoko@weather.utande.co.zw | Department of Meteorological Services |
| 87. Zimbabwe | Charles Kawadza<br>ZBC Pockets Hills<br>P.O. Box 444<br>Highlands, Harare<br>Tel: 263-4-498670<br>Fax: 263-4-498615<br>Email: ckawadza@yahoo.com | Zimbabwe Broadcasting Corporation |
| 88. Zimbabwe | Ms S. Ndlovu<br>Department of Civil Protection<br>Min of Local Government<br>P/B 7706, Causeway, Harare<br>Tel: 263-4-792478<br>Fax: 263-4-703715<br>Mobil: 263-11804882 | Department of Civil Protection |
| 89. Zimbabwe | Mr. D. Simela<br>Cadula Agro Business,<br>P.O.Box AC1228 Ascot, Bulawayo<br>Mobile: 263-91350595<br>**Email:** 240194@ecoweb.co.zw | Cadula Agro Business |
| 90. Zimbabwe | Mr. D. M. Nyoni<br>Cadula Agro Business, P.O. Box AC1228 Ascot, Bulawayo<br>Mobile: 263-91301274/91240194<br>Email: 240154@ecoweb.co.zw | Cadula Agro Business |
| 91. Zimbabwe | Mr. Greek Ncube<br>Zimbabwe Farmers' Union<br>P.O. Box 3755, Harare<br>Tel: 263-4-251864/2<br>Fax: 263-9-250925<br><br>P.O. Box 3836, Bulawayo<br>Tel: 263-9-70796<br>Mobile: 263-91382357<br>Email:zfuhq@africaonline.co.zw | Zimbabwe Farmers' Union |
| 92. Zimbabwe | Mr M.Kadzatsa<br>Ministry of Health and Child Welfare<br>P.O. Box CY 1122 Causeway, Harare<br>Tel: 263-4-729032/726940<br>Email: smidzi@healthnet.zw<br>Email: mangwiro@healthnet.zw | Ministry of Health and Child Welfare |

| | | |
|---|---|---|
| 93. Zimbabwe | Dr A. Makarau<br>University of Zimbabwe<br>Department of Physics<br>P.O. Box MP167 Mt Pleasant, Harare<br>Tel: 263-4-303211<br>Fax: 263-4-333407<br>Email: makarau@science.uz.ac.zw | University of Zimbabwe |
| 94. Zimbabwe | Mr B. Chipindu<br>Department of Physics<br>University of Zimbabwe<br>P.O. Box MP167, Mt Pleasant, Harare<br>Tel: 263-4-303211<br>Fax: 263-4-333529<br>chipindu@science.uz.ac.zw | University of Zimbabwe |
| 95. Zimbabwe | Dr M. C. Zinyowera<br>Midlands State University<br>Dept. of Geog. And Env. Studies<br>P. Bag 9055, Gweru<br>Tel: 091256164<br>e-mail: lamaz@africaonline.co.zw<br>email: _zinyowera@hotmail.com | Midlands University |
| 96. Zimbabwe | Dr. Reneth Mano<br>University of Zimbabwe<br>Department of Agricultural Economics<br>P.O. Box MP 167, Mt. Pleasant, Harare<br>Tel: 263-4-303211<br>rtmano@africaonline.co.zw | University of Zimbabwe |
| 97. WMO | Mr V. A. Simango<br>World Meteorological Organisation<br>7bis de la Paix<br>Case Postale No. 2300<br>CH-1211 Geneva 2<br>Switzerland<br>Tel: 41-22-7308303<br>Fax: 41-22-7308047<br>Email: simango_V@gateway.wmo.ch | World Meteorological Organization |
| 98. SATCC | Mr A. S Dlamini<br>Southern Africa Transport and Communications Commission (SATCC)<br>Av. Martires de Inhaminga 170, Predio Marconi C. P. 2677, Maputo<br>Mozambique<br>Tel: 258-1-420214/420246/429177/309223<br>Fax: 258-1-420213/431288<br>Email: sdlamini@satcc.org | Southern Africa Transport and Communications Commission (SATCC) |
| 99. DMC Harare | Dr. Buruhani S. Nyenzi<br>Drought Monitoring Centre<br>P.O. Box BE 150, Belvedere<br>HARARE<br>Tel: 263-4-778172<br>Fax: 263-4-778172<br>Email: bnyenzi@dmc.co.zw | Drought Monitoring Centre Harare |

| | | |
|---|---|---|
| 100.DMC Harare | Mr. B.J. Garanganga<br>Drought Monitoring Centre<br>P.O. Box BE 150, Belvedere<br>HARARE<br>Tel: 263-4-778172<br>Fax: 263-4-778172<br>Email: garangan@dmc.co.zw | Drought Monitoring Centre Harare |
| 101.DMC Harare | Ms S.T. Mangena<br>Drought Monitoring Centre<br>P.O. Box BE 150, Belvedere<br>HARARE<br>Tel: 263-4-778172<br>Email: dmcgen@dmc.co.zw | Drought Monitoring Centre Harare |
| 102.DMC Harare | Ms S.R. Ruzvidzo<br>Drought Monitoring Centre<br>P.O. Box BE 150, Belvedere<br>HARARE<br>Tel: 263-4-778172<br>Email: ruzvidzo@dmc.co.zw | Drought Monitoring Centre Harare |
| 103.DMC Nairobi | Mr S. Muiruri<br>Drought Monitoring Centre Nairobi<br>P.O. Box 30259<br>Nairobi, Kenya<br>Tel: 254-2-578340<br>Fax: 254-2-578343<br>Email: muiruri@lion.meteo.go.ke | Drought Monitoring Centre Nairobi |
| 104. SADC Water Sector | Mr L De Almeida<br>SADC Water Sector<br>P. Bag A440, Maseru 100<br>Lesotho<br>Tel: 266-8868666<br>Fax: 266-325766<br>Email: almeida@ilesotho.com | SADC Water Sector |
| 105. SADC Water Sector | Mr Mukoane<br>SADC Water Sector<br>P. Bag A440, Maseru 100<br>Lesotho<br>Tel: 266-320720/310022<br>Fax: 266-310465<br>Email: sadcloscee@lesoff.co.za | SADC Water Sector |
| 106. SADC RRSU | Dr K Masamvu<br>Regional Remote Sensing Unit<br>Harare, Zimbabe<br>P.O. Box 4046<br>43 Robson Manyika Avenue<br>Tel:263-4-736051(W) 744933(H)<br>Fax: 263-4-795283<br>Email: kmasamvu@fanr-sadc.co.zw | Regional Remote Sensing Unit |

| | | |
|---|---|---|
| 107. SADC RRSU | Dr E Mukhala<br>Regional Remote Sensing Unit<br>P.O. Box 4046<br>Harare, Zimbabwe<br>43 Robson Manyika Avenue<br>Tel:263-4-736051(W) 744933(H)<br>Fax: 263-4-722723<br>Email: emukhala@fanr-sadc-co.zw | Regional Remote Sensing Unit |
| 108. SADC REWS | Mr R Masundire<br>Regional Early Warning System<br>Merchant House, 43 Robson Manyika, Harare,<br>Zimbabwe<br>Tel: 263-4-736051<br>Tel: 263-4-795545<br>Email: rmasundire@fanr-sadc.co.zw<br>Email: masundir@ecoweb.co.zw | Regional Early Warning System |
| 109. USAID | Nicholas Jenks (Disaster Relief Officer)<br>USAID, Rua Damiao de Gois<br>Maputo Mozambique<br>Tel:258-1-491667/492098<br>Email: njenks@usaid.gov | USAID |
| 110. WHO | Dr S Murugasampillay<br>World Health Organisation<br>P.O. Box CY 348, Causeway, Harare<br>Zimbabwe<br>Tel: 263 4 253724/30<br>Fax: 263 4 254731<br>Email: shivamal@samara.co.zw | World Health Organisation |
| 111. WHO | Mr D. Shambare<br>World Health Organisation<br>P.O. Box CY 348, Causeway, Harare<br>Zimbabwe<br>Tel: 263 4 253724/30<br>Fax: 263 4 254731<br>Email: shambared@who.co.zw | World Health Organisation |
| 112. WHO | Mr R Orford<br>World Health Organisation<br>P.O. Box CY 348, Causeway, Harare<br>Zimbabwe<br>Tel: 263 4 253724/30<br>Fax: 263 4 253731<br>Email: orfordr@who.co.zw | World Health Organisation |
| 113. WHO | Mr W. Dodoli<br>World Health Organisation<br>P.O. Box 30390 Lilongwe 3<br>Malawi<br>Tel: 265 772755<br>Email: whomalawi@malawi.net | World Health Organisation |

| | | |
|---|---|---|
| 114. ACMAD | Mr A Kanga<br>African Centre for Meteorological Applications for Development<br>2 Avenue des Ministeres<br>B.P. 13184 Niamey<br>Niger<br>Tel: 227 72 3160/734992<br>Fax: 227 723627<br>Email: climate_unit@acmad.ne<br>Email: alphonse_kanga@yahoo.fr | African Centre for Meteorological Applications for Development |
| 115 FEWS/NET | Antonio S.Mavie<br>USAID/FEWS/NET<br>Rua Damiao de Gois, 523, Maputo<br>Mozambique<br>Tel: 258-1-494488<br>Fax: 258-1-499791<br>e-mail: amavie@fews.net | FEWS/NET |
| 116. FEWS NET | Mr. E. Chapasuka<br>FEWSNET<br>USAID FEWS NET Project<br>P.O. Box 30455, Lilongwe 3,<br>Malawi<br>Tel: 265-754892<br>Fax: 265-754892<br>Email: fewsmu@malawi.net | FEWSNET |
| 117.FEWS/NET | Ms Maria Orlanda Bata<br>USAID/FEWS/NET<br>Rua Damiao de Gois, 523, Maputo<br>Mozambique<br>Tel: 258-1-494488<br>Fax: 258-1-499791<br>e-mail:obata@fews.net | USAID/FEWS/NET |
| 118.FEWS/NET | Mr. Anthony John Armando<br>Famine Early Warning System Network, 4th Floor Merchant Hse<br>43 Robson Manyika Ave, Harare<br>P.O. Box 4046, Harare,<br>Zimbabwe<br>Tel: 263-4-729196<br>Fax: 263-4-729196<br>email: aarmando@fews.net | FEWS/NET |
| 119.FEWSNET | Mr. E.da Silva Machava<br>FESSNET International<br>Rua Av Paore Andre Fernandes 122, Maputo,<br>Mozambique | FEWSNET |
| 120. FEWSNET | Mr. M.P. Mazuze<br>Lando do ribatop No. 13 $1^0$ Ander, Maputo,<br>Mozambique<br>Tel: 258-1-823070/400822<br>Fax:256-1-400350 | FEWSNET |

| | | |
|---|---|---|
| 121. USGS | Kwabane O Asante<br>US Geological Survey<br>EROS Data Centre<br>Sioux Falls, South Dakota<br>57198 USA<br>Tel: 605 594 2766<br>Fax: 605 594 6529<br>Email: asante@edcmail.cr.usgs.gov | US Geological Survey<br>EROS Data Centre |
| 122. World Food Programme | Ms F. M. Street<br>World Food Programme<br>P.O Box 30571<br>Lilongwe<br>Malawi<br>Tel: 265 774666<br>Email:francesca.street@wfp.org | World Food Programme (WFP) |