WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR BASIC SYSTEMS

MEETING OF SEVERE WEATHER FORECASTING DEMONSTRATION PROJECT – REGIONAL SUBPROJECT MANAGEMENT TEAM

RA I SOUTH EASTERN AFRICA (RA I / RSMT-SWFDP)

MAPUTO, MOZAMBIQUE, 27 FEBRUARY – 2 MARCH 2007

FINAL REPORT

1 Opening

1.1 At the kind invitation of the Government of Mozambique, the meeting was held at the National Meteorological Institute of Mozambique. Mr Filipe Lùcio, Director of the National Institute, and Permanent Representative of Mozambique with WMO opened the meeting at 9:15 am, 27 February 2007. The meeting was chaired by the Chairperson of the Regional Subproject Management Team, Mr Mnikeli Ndabambi (South Africa).

Opening address by the Permanent Representative of Mozambique with WMO

1.2 Mr Lùcio welcomed the meeting to Maputo and the National Institute. In his opening address, he stated that"… despite many international initiatives on disaster risk management, and advances in scientific knowledge and applications, the social and economic impacts of natural disasters are growing. Good examples are the floods in the central part of Mozambique and Tropical Cyclone FAVIO that has caused death and devastated the towns of Vilankulos and Machanga. It is a sobering realization that the impact of natural hazards has by any measure – frequency of occurrence of disasters, deaths, economic impact – increased in the last decade.

1.3 "The incidence and impact of disasters are increasing in Africa, mostly due to rising vulnerability from several factors such as poverty (the dominant), development pressures (including low economic growth, rising population pressures and unplanned urbanization), fragile and degraded environment, disease, armed conflict and weak governance. According to the Centre for the Epidemiology of Disasters Database, Africa is the only continent where the regional share of reported disasters in the world total has increased over the last decade. Disasters of hydro-meteorological origin (drought, flood and wind storms) dominate (59% of the total natural disasters), followed by epidemics and insect infestations (36%), in the period 1975-2002.

1.4 "An alarming feature is the increasing trend in the number of people affected by natural hazards of hydro-meteorological origin in the same period, with drought, flooding and wind storms accounting for 90% of the total number of people affected.

1.5 "These evidences call for the need of reversing the trend of increasing vulnerability that requires better early warning systems and addressing disaster risk management as a development issue, since disaster and development are inextricably linked.

1.6 "Mozambique has pursued different initiatives to address disaster risk reduction, but the country is still far from realizing an effective early warning systems that must be people-centred and must integrate four elements: (i) knowledge of the risk faced; (ii) technical monitoring and warning services; (iii) dissemination of meaningful warnings to those at risk; and (iv) public awareness and preparedness to act. Failure in any of these elements can mean failure of the whole early warning system and consequently devastating impacts to the economy of the country and lives of the population.

1.7 "Meteorological Services in Africa are highly differentiated in their capabilities to deal with disaster risk reduction issues. In most cases these Services are struggling and often failing to provide adequate products and services for disaster risk reduction and for the benefit of the various socio-economic sectors. Human

resource and capacity limitations are frequently cited as the major impediment to initiating and realizing demand driven products and services.

1.8 "The Severe Weather Forecasting Demonstration Project whose management team you are members is in our opinion a great opportunity to help empower participating countries to better support activities aimed at reducing risks from natural hazards.

1.9 "It is however important to stress that the results of this project will greatly depend on your commitment to the project and involvement in its activities. As I indicated at the beginning, Africa is the only place in the world where impacts of disasters are increasing. As part of the Management team of the Severe Weather Forecasting Demonstration Project you have the opportunity to contribute meaningfully to changing the course of events. Thus, I sincerely hope that the results of your work do not become another workshop, but a step towards reducing risk in Africa."

1.10 Mr Ndabambi welcomed the participants, and also stressed the importance of both the Regional Subproject in southeastern Africa, as well as that this meeting is taking place following a few months of implementation. The meeting must both report on the project's status as well as decide on its future.

1.11 Mr Peter Chen of the Secretariat, on behalf of the Secretary General WMO, stressed the importance of this meeting of the Management Team, at this point of the demonstration project. He noted in particular that in this Regional Subproject, while the Data-Processing and Forecasting System (DPFS) implementation aspects will be thoroughly discussed, this meeting also includes an agenda item dealing with aspects of weather warnings as a service provided by the NMHS to the public and to national organizations dealing with disaster management and civil protection, i.e., the Public Weather Services (PWS) Programme and Disaster Prevention Mitigation (DPM) aspects.

2 Organization

2.1 Approval of agenda. The meeting adopted the Agenda, which can be found in Annex I.

2.2 Agreement of working arrangements. The meeting agreed to work as a single committee for the entire meeting.

2.3 The meeting welcomed the new member for Zimbabwe on the Management Team, Mr Hector Chikoore. The current list of members of the Management Team is found in Annex II.

2.4 The list of participants is found in Annex III.

3 Introduction to the Severe Weather Forecasting Demonstration Project (SWFDP)

3.1 The Secretariat presented the background of the SWFDP, including its history (CBS activity since 2003), the planning that lead to the Regional Subproject in RA I, south-eastern Africa, the outcome of CBS-Ext.(06) (Seoul, Nov. 2006), as well as broad support from the Fifteenth Session of RA I (Ouagadougou, February 2007) related to this subject. There is considerable support and expectations for this

project, and with its success, other subprojects may be implemented in other regions of Africa and in other WMO Regions.

3.2 The meeting, at its opening, took the opportunity to discuss in general tems the major challenges experienced in the implementation so far, mainly those experienced by RSMC Pretoria, and the participating Centres of Botswana, Madagascar, Mozambique, Tanzania, and Zimbabwe. Details of these aspect were reported in the individual reports of the participating centres, and summarized under Agenda Item 4 (below).

3.3 In summary among the most serious challenges are:

- Achieving adequate Internet access to SWFDP products by the NMHSs;
- Achieving sufficient level of capability to routinely use the SWFDP by the NMHSs;
- Severe weather of high rainfall and strong winds associated with short-lived intense and localized convective activity can cause localized damage, however they not well predicted by global numerical weather prediction models;
- Achieving an adequate level of operational communications among the participating centres;
- Receiving feedback from participating NMHS both in real-time (observed severe weather) as well as the completed post-severe weather Evaluation Forms following each event for the primary purpose of evaluating the overall success of the project relative to its goals.

3.4 The meeting agreed to measures for optimizing the implementation and successful completion of the SWFDP.

- To achieve adequate and reliable Internet access to SWFDP products, RSMC Pretoria noted that it has recently doubled its bandwidth, while some of the NMCs are in the process of improving their respective connectivity to the Internet. Notwithstanding, Internet access for some NMCs will continue to be less than adequate.
- Many of the SWFDP products are new to the participating NMCs. Additional familiarization, routine use, and training within NMCs (e.g. using the CD of lectures from the Preparatory Training, or other online resources) on the use of certain products could be helpful.
- Short-lived, highly localized convective activity experienced in this region that bring heavy rain and strong winds is not well predicted by presently available global NWP models. Likely, nowcasting tools that depend on radar detection and processing methods would be best suited for predicting these phenomena. In general, the NMHSs have very few or no reliable weather radars systems. It was also noted that high-resolution MSG imagery should be helpful in this regard. There is a need to optimally use the available training material on MSG for nowcasting. Actual reports of localized heavy rainfalls or strong winds should be shared among the RSMCs and NMCs.
- The meeting noted the serious gap in rainfall measurements needed for flood warnings due to heavy rain. It would be highly desirable if EUMETSAT couold improve rainfall estimation form MSG to fill this gap.
- NMCs are reminded to complete the Evaluation Form as required by the Implementation Plan immediately following an actual severe weather

event, or one that was forecast, NMCs are requested to fill the Form (template is linked to the RSMC Pretoria Web Home Page), and return to RSMC Pretoria, in good time Having noted that the evaluation forms have not been fully completed at times, the NMCs should as much as possible provide all request information.

- To achieve a greater knowledge and understanding of the regional climatology of severe weather events and the possible impacts of climate change on the occurrence of these events, the meeting agreed that all centres should be encouraged to continue to compile and utilise statistics of past, present and future severe weather events. To help in this regard, the meeting was informed of the Met Office VCP web-based 'Statistics in Applied Climatology' course (E-SIAC) and the 'Climate for Development in Africa' initiative (ClimDev Africa). Further details on E-SIAC can be found at:

  www.metoffice.gov.uk/corporate/international/ukvcp.html

  and for ClimDev from the UK Department for International Development (DfID).

Operational communications

3.5 Operational communications are those that take place in real-time as the severe weather is occurring. The meeting felt that exercising this kind of communications will help improve both the daily RSMC Pretoria guidance products as well as the warnings themselves. NMCs are encouraged to initiate the call to RSMC Pretoria to provide information of actual severe weather conditions, while RSMC Pretoria is encouraged to call the NMCs to confirm up to the minute critical information before guidance is issued, particularly for the short-range guidance.

3.6 In the event that the routine daily guidance products have not yet been updated, NMCs are welcomed to contact RSMC Pretoria for consultations and verbal updates.

3.7 The NMCs and RSMC Pretoria agreed to share operational e-mail addresses, fax and telephone numbers. These are listed and found in Annex IV. This information will be then posted to a web page linked to the RSMC Pretoria Home Page.

3.8 It was further emphasized that RSMC Pretoria is willing to provide guidance for the forecasting of severe weather (heavy rainfall and strong winds) on a 24/7 basis, while understanding that in order to be able to maintain this capability, it requires real-time information from the participating NMCs, including observations, reports, or impacts information related to the actual occurrence of such events. RSMC Pretoria emphasized that receiving feedback from the NMCs would be motivating for the forecasters as they execute their RSMC functions.

4 Status of the Regional Subproject

Global products centres

4.1 The meeting received the status reports of the global products centres: ECMWF (introduced by Secretariat), Met Office UK, and NCEP (Africa Desk, USA). These Centres have met their commitments to support this project by providing their respective products as per the Implementation Plan.

4.2 RSMC Pretoria and the participating NMHSs acknowledged that all these products are used, the majority of them are very useful and perform well, and some products are essential to severe weather forecasting. RSMC Pretoria requires the global products from these global centres to produce its daily severe weather forecasting guidance products. The NMHSs require the daily guidance products for their respective national severe weather forecasting and warnings programmes. Effectively, some of the products are already considered as part of the NMHSs operational severe weather forecasting process.

4.3 The NMHSs enthusiastically recognized these global centres for providing valuable NWP guidance for the southern Africa region. In all NMHSs, since the commencement of the SWFDP, the availability of global products provided under the SWFDP have dramatically changed the weather warnings programme in their country.

4.4 The NMHSs are continuing to learn how to use EPSgrams; their usefulness was especially recognized for the outlook period for possible severe weather conditions beyond day-5. Further guidance on the use of EPS products is available on the SWFDP Preparatory Training Web site and CD.

4.5 The global products centres emphasized the need to receive feedback on their respective NWP/EPS products, collected by the RSMC Pretoria and forwarded to the global centres, with the view to improve their respective global numerical models.

4.6 The NCEP, through attachment to its Africa Desk, has been working with the NMHSs to interpret NWP products, develop diagnostic product guidance material on potential of severe weather up to 3 days lead-time, and assist in forecast evaluations. Three visitors, from Botswana, South Africa, and Tanzania, have been attached to the Africa Desk so far. A fourth meteorologist from Mozambique is expected to work at the Africa Desk in March 2007. The meeting acknowledged this training approach as very valuable and effective.

4.7 The NCEP is prepared to provide archived GFS data, satellite rainfall estimates, and ensemble training case studies on the NCEP/CPC Web sites (or DVD if necessary), if required, for example to support development of case studies.

4.8 The Met Office UK, in addition to providing NWP guidance for the SWFDP, led the development of the 4-day Preparatory Training course at RSMC Pretoria just prior to the demonstration phase of the project. ACMAD collaborated in the design and development of this course. Two members of staff, including Paul Davies, a Chief Forecaster at the Met Office Operations Centre, then led the delivery of the training course. An accompanying 'MOODLE' training website http://www.met-elearning.org/moodle/ (courses\SWF in Africa) with NWP training resources, useful links and feedback forums was also developed by the Met Office to facilitate additional learning both before and after the classroom element of the course.

4.9 The Met Office African Limited Area Model (ALAM) available through a dedicated Web site: www.metoffice.gov.uk/weather/africa/lam/ will soon be available in GRIB format via EUMETcast. Further information accessing ALAM GRIB will be provided to participants when EUMETcast dissemination commences in the next couple of months.

4.10 The Met Office UK MOGREPS products, including probability charts and EPSgrams, were recently made available through a hyperlink on the RSMC Pretoria Web site.

4.11 The ECMWF products have been provided through a dedicated password protected Web site at ECMWF; this site is also hyperlinked from the RSMC Pretoria Web site. All products were considered to be extremely useful by the NMHSs, and some NMHSs felt that these have become essential to their respective severe weather forecasting processes.

RSMC Pretoria

4.12 The RSMC Pretoria (South Africa) is a designated Regional Specialized Meteorological Centre (RSMC) with geographical responsibility for Southern and Central Africa. In this capacity the RSMC Pretoria agreed to participate as the principal RSMC in the CBS Severe Weather Forecast Demonstration Project (SWFDP) in southeastern Africa. It plays the central role in the SWFDP for providing severe weather forecasting guidance to the project's NMHSs.

4.13 The role of RSMC Pretoria in the "cascading forecasting process", a concept of the project, is to "interpret information received from global NWP centres, run a limited area model to refine products, liaise with participating NMCs", as prescribed by the Regional Subproject Implementation Plan. In this process RSMC Pretoria is specifically tasked to issue daily severe weather forecasting guidance for day-1 to day-5 to the NMCs, advising them about potential heavy rain or strong winds according to the information received from the global NWP centres, its own limited-area model, and any other relevant information.

4.14 Through the SWFDP, RSMC Pretoria is exploring the enhancement of the role of RSMCs with Geographic Specialization into providing regional severe weather forecasting guidance.

4.15 The RSMC Pretoria successfully implemented its responsibilities by the first few weeks of the commencement of the demonstration phase of the project, including revitalized its dedicated RSMC Web site, and enhanced it to act as a efficient single Web portal for participating centres to access all SWFDP products and information. The Web address is www.weathersa.co.za/RSMC (password protected).

4.16 Products from RSMC Pretoria available on this Web site also include the UM SA12 limited-area model, post-processed fields of the NCEP EPS system as used by the South African Weather Service. An archive of the guidance products will also be linked to the RSMC Pretoria Web page.

4.17 GRIB products are also available from the UM SA12 model run at RSMC Pretoria, although the dissemination of these files to NMHSs require high-speed data lines which are not readily available. Other dissemination channels such as EUMETcast, similar to the distribution of the UK ALAM products, are currently being investigated.

4.18 All RSMC Pretoria's daily SWFDP guidance products as well as the UM SA12 products, starting 6 November 2006, have been archived.

RSMC La Réunion

4.19 While the operational functions and products from RSMC La Réunion were unchanged for the SWFDP, the meeting agreed that its functions and products are very good and essential for the forecasting Tropical Cyclones in the region.

4.20 Guidance from RSMC La Réunion is incorporated into the RSMC Pretoria SWFDP guidance.

4.21 Since November 2006 RSMC La Réunion is running operationally a new meso-scale NWP model on the South-West Indian Ocean. This ALADIN model covers a good portion of the area of responsibility of RSMC La Réunion. The model has its own assimilation cycle (3 D-VAR). Its horizontal resolution is 10km, for the analysis as well as for the forecast. The domain includes, in particular, Madagascar.

4.22 The meeting agreed that the outputs of this new meso-scale model would be useful to RSMC Pretoria as well as NMHS Madagascar. Arrangements for the transfer of outputs will need to be made.

4.23 The meeting noted that information on the RSMC La Reunion Web site is not readily understood by all SWFDP participating centres and requested every effort be made to make the most critical information on the Web site available in English.

ACMAD

4.24 While the Implementation Plan called for ACMAD to archive NWP data during the SWFDP primarily for developing case studies and learn from experiences to determine, for example, training needs for African NHMSs, it also collaborated with the Met Office UK in the development of the Preparatory Training for the project. The ACMAD archive for the project is available to NHMSs for developing case studies.

4.25 The ACMAD also commenced producing a Southern Africa Synthetic Forecast (SASF) product, which is accessible via its Web site. This product follows closely to a model of a guidance product that was developed within the AMMA project for West Africa whose Special Observational Period (SOP) terminated in September 2006. ACMAD continues to produce West African Synthetic Forecast products contained in its daily AMMA forecast bulletin. ACMAD Web site is hyperlinked from the RSMC Pretoria Web site.

4.26 One forecaster from NMC Zimbabwe has been on attachment at ACMAD and is actively contributing to forecast production for ACMAD and in data archiving for the Severe Weather Forecasting Demonstration Project.

NMHSs of Botswana, Madagascar, Mozambique, Tanzania, Zimbabwe

4.27 The highlights of the status of implementation for the participating NMHSs are noted in the following paragraphs. For the purpose of this report of the meeting, the individual submitted reports of the participating centres have been annexed, as follows: Botswana (Annex V.1), Madagascar (Annex V.2), Mozambique (Annex V.3), Tanzania (Annex V.4), Zimbabwe (Annex V.5).

4.28 **Botswana**

- No problem experienced accessing products via the RSMC Pretoria Web site, by Internet;
- Severe weather (strong winds) were experienced in November 2006 possible (case studies). No severe weather since that time;
- Localized regions of strong winds not well predicted by models;
- Models are particularly good and useful for precipitation forecasting.

4.29 **Madagascar**

- Poor connectivity - Internet access is difficult and e-mail not reliable;
- Daily guidance products from RSMC Pretoria are used, when available;
- Need more training on how to use products;
- SWFDP has improved severe weather forecasting, e.g. flooding was well predicted consequently the warnings were accurate especially in Antananarivo: the loss of life was reduced (only 7 deaths during the disaster);
- Many very high rainfall events were reported during the period December 2006 to 16 February 2007.

4.30 **Mozambique**

- Internet connectivity is at times slow – downloading of important products is not always possible;
- Daily guidance products from RSMC Pretoria very useful;
- Possible case study 20-21 January 2007, when daily guidance missed the heavy rains;
- Many products are important, noted in particular various stability indices for forecasting convection.
- Need more training on use of products (indices), analysis of tephigrams.

4.31 **Tanzania**

- Internet connectivity is at times slow;
- Daily guidance products form RSMC Pretoria is useful particularly for heavy rainfalls, however has not been capturing localized short-lived thunderstorms that can produce damaging winds;
- Possible case study – 28-29 December 2006;
- Compares with its own WRF model products;
- Underestimates rainfall in coastal areas; underestimates wind speeds over the nearby Indian Ocean;.
- Insufficient upper air observations to adequately support severe weather forecasting.

4.32 **Zimbabwe**

The meeting recognized the particularly comprehensive report of Zimbabwe, including:

- Internet connectivity is at times slow ;
- Initially, there was suspicion over the new unfamiliar products;
- Cascaded in-house training to all its forecasters by the representatives who had first received training at the Preparatory Training session;
- Zimbabwe does not generally experience strong winds, however lots of heavy rainfall events;
- Possible case studies – New Year's Day 2007, and TC Favio (Feb. 2007);
- Improved dramatically relations with civil protection and the press;
- Small-scale high rainfall event are missed by models and guidance;
- Important to understand the behaviour of models, such as its limitations – this is leads to forecasters adding value to severe weather forecasting;

- Insufficient upper air observations to adequately support severe weather forecasting.
- Succeeded in getting major press interest in the forecast and warning of TC Favio;
- Increased credibility of the Zimbabwe Weather Service since the SWFDP;
- Request the two locations for UK MOGREPS EPSgrams to be changed to more appropriate locations.

4.33 The meeting decided to use Zimbabwe's listing of all high rainfall events as a basis for developing a template for quarterly reporting by the NMHSs.

Training aspects

4.34 To further assist in the training of forecasters at the NMHSs, Met Office UK and the Secretariat agreed to assist in contacting UCAR – COMET (USA) to obtain DVD versions of the COMET Web-based pages on EPS, stability indices, and possibly other modules relevant to severe weather forecasting for distribution to the NMHSs. The relevant COMET modules will be linked from the SWFDP Preparatory Training Web site although it is recognized that some of the participating NMHSs have problems with Internet connectivity and line speed.

4.35 The meeting noted the value and therefore the need, resources permitting, for training events, and for attachments of forecasters at NWP centres, RSMCs and at other NMCs for on-the-job training and the opportunity to share forecasting experiences.

4.36 The usefulness of developing case studies was re-emphasized for training activities as well as, in the long run for improving all guidance products, hence also forecasts and warnings. In addition these case studies will serve as evidence demonstrating the effectiveness and usefulness of the project.

4.37 The meeting noted the importance of AMDAR especially ascent and descent data to in part address the shortage of upper air sounding data and would like to receive further guidance materials on the use and interpretation of AMDAR data. The meeting was encouraged to support any moves to increase the availability of AMDAR data and the installation of more AMDAR humidity sensors on aircraft.

Evaluation of Regional Subproject

4.38 The Met Office UK presented a paper on aspects to be considered and questions to be answered in the evaluation of the subproject, while the demonstration is ongoing, and for final overall evaluation. The questions were intended to assist in determining how the project is positively affecting the severe weather forecasting process to result in better forecasts and warnings as well as better warnings services. Four project aspects are considered: RSMC Pretoria daily guidance products, NWP products, severe weather warnings, and NMHS coordination with disaster management and civil protection agencies, for improved communications and service delivery.

4.39 The meeting agreed that in order to be able to assess the impacts and results of the SWFDP, it is important to establish the pre-SWFDP benchmark of each NMHS's severe weather forecasting and warnings programmes, i.e., before November 2006. The NMHSs agreed to prepare a description of their respective benchmarks.

4.40 The meeting agreed that all NMHSs will prepare quarterly reports on the status of the SWFDP in their respective countries. (Note: this is separate from the Evaluation form that is required to be filled following each incident where severe weather occurred, or was forecasted.)

4.41 The quarterly reporting periods and deadlines:

Report No.	Months (inclusive)	Report to be received by:
1	Nov. 2006 – Feb. 2007	31 March 2007
2	Mar. 2007 – May 2007	30 June 2007
3	June 2007 – Aug. 2007	30 Sep. 2007
4	Sep. 2007 – Nov. 2007	31 Dec. 2007

4.42 Each quarterly report will include at least one case study related to a severe weather forecasting case (actual event or a forecasted event that did not occur). .

4.43 The meeting agreed on the quarterly report structure and content and developed a template to assist NMHSs to produce the reports. The template is found in Annex 6 to the report.

4.44 The quarterly reports will be distributed to all members of the Management Team, and the Secretariat (Mr Peter Chen).

4.45 The quarterly report will be the basis on which the overall evaluation of the project will be developed.

Operational Implementation, November 2007

4.46 The Chairman emphasized the importance of this issue, noting that the Implementation Plan that was developed in August 2006 was for the sole purpose of undertaking the demonstration phase of the SWFDP subproject. The Management Team was reminded of the implications of “operational implementation”, which in principle guarantees commitments of 24/7 support for production components that meet operational requirements. At the same time, global centres would likely be willing to continue to provide their products as they have been during the demonstration phase, and may not be prepared to provide full operational support.

4.47 The meeting decided that a good strategy would be for the participating NMHSs to communicate to ECMWF, Met Office UK, NCEP/Africa Desk, as well as RSMC Pretoria (and “cc’d” to the Secretariat), requesting them to continue their level of support for severe weather forecasting in their respective countries, beyond the end of the SWFDP, and that as much as possible to support operationally the “cascading forecasting system” that has demonstrated to have resulted in real and significant benefits to the warnings programmes of the country and region. In addition, and as much as possible, this correspondence should include concrete evidence (possibly attaching a quarterly report) with respect to the enhancement of the warnings programme.

4.48 In addition, the Secretariat could prepare correspondence to the Permanent Representatives and/or Directors of the participating centres to inform them on the progress of the SWFDP, and to invite them to consider continuing their support in sustaining the measured benefits realized during the SWFDP.

4.49 The meeting acknowledged that the future of the SWFDP could also be influenced by the feedback of national agencies outside of the NMHSs, in particular by disaster management and civil protection agencies. These agencies, as end users of severe weather forecasting and warnings programmes could express their opinions on the successes, challenges, and future direction of the SWFDP, to the Management Team, or directly to their respective Permanent Representatives with the WMO.

4.50 In this approach, the global centres and RSMC Pretoria would be invited to confirm their intentions to support the NMHSs of the southern Africa region beyond the SWFDP.

4.51 Following the termination of the SWFDP, and in anticipation of the continuation of the established “cascading forecasting system”, a new management and coordination framework would be needed to maintain the system and manage future enhancements of severe weather forecasting in the subregion, for example to include those NMHSs of the subregion of southern Africa that did not participate in the SWFDP.

5 Public Weather Services- Coordination between public weather service providers and disaster management

5.1 The Secretariat presented the main principles in the role of the WMO Public Weather Services (PWS) Programme regarding coordination between National Meteorological and Hydrological Services (NMHSs) and the stakeholders in the hazards community and in particular the disaster management authorities. Coordination is essential between NMHSs and the disaster management in all stages of a severe weather warning system from mitigation and preparedness through the response and warning and finally the recovery phases. It was emphasized that without proper coordination each of these phases was likely to suffer due to lack of, awareness of user needs and provider capabilities; mutual trust; proper communication and identified authority for issuing warnings. Coordination should therefore be pursued at all levels with all sectors and institutions that either are major users of meteorological information, or can assist in production and delivery of such information and in any case whose mandate makes coordination with them essential in effective delivery of services. Two important such sectors are the media and disaster management authorities.

5.2 The meeting agreed that public weather services have an important contribution in the overall efforts of NMHSs in disaster risk management in particular in dissemination and communication of warnings and forecasts to the users and public. This contribution will ultimately lead to the effective translation of environmental information into informed decisions and actions. Cross training between meteorologists and decision makers in an effort to strengthen an all hazards community and creating greater public awareness of hazards and their prevention and mitigation are also part of the contributions made by public weather services of NMHSs.

5.3 The meeting identified the factors that could potentially contribute to ineffectual warnings. These include:

- Forecasts and warnings inaccuracies and lack of timeliness,
- Lack of a sole authority in issuing warnings,
- Communication and dissemination inadequacies,

- Low credibility of the NMHS and inadequate staffing,
- Ineffective and haphazard coordination with disaster management,
- Inadequate and unsuitable warning content and language,
- Lack of or poor media relations.

5.4 The meeting agreed that communication of warnings constituted an essential link in a successful warning system. The importance of ensuring that the recipients understand, believe and act upon the information disseminated by the NMHS and the end-to-end-to-end warnings and forecasts process was emphasized. The meeting also stressed on the role of public weather services as an integrated element of a severe weather warnings system. Building and improving capability in NMHSs participating in the SWFDP to communicate with all stakeholders at all levels and to lead the efforts of the NMHS in public education and outreach in order to influence public behavior in responding to warnings was considered a major contribution of public weather services to the success of the project.

5.5 The meeting stressed the importance of the role of the media as an essential element in the delivery of warnings and forecasts and requested that media also be included in cross-training activities.

5.6 The Secretariat also presented the results of the surveys of NMHSs that had been carried out through the WMO DPM Programme. The purpose of the survey had been to identify the hazards of meteorological and hydrological origins affecting the WMO Member counties; the participation of NMHSs in national organizations involved in disaster risk reduction; capabilities of NMHSs in delivering products and services to those organizations, and major gaps and need as regards those capabilities. The survey had revealed gaps in governance, organizational and technical areas, and the need for capacity building especially in areas of public education and outreach and cross training between NMHSs and disaster management authorities.

5.7 The meeting noted the requirements for improvement and strengthening of linkages between NMHSs and other organizations at national and regional levels to allow better integration of NMHSs services and products in support of pre- and post-disaster emergency preparedness and response operations. In noting the proposed extended scope of the SWFDP, the meeting expressed the view that linkages should be made between civil protection authorities and international and regional humanitarian agencies so as to ensure the proper portrayal of an emergency situation by both organizations. In addition, a linkage should be put between RSMCs and the international charter “space and major disasters”, and a two-way links between RSMCs and NMHSs. Finally the meeting agreed on the desirability of explicit inclusion of global centres as well as regional centres in the proposed scheme.

Disaster management authorities of Botswana, Madagascar, Mozambique, Tanzania, South Africa and Zimbabwe

5.8 The meeting received reports from all the countries participating in the SWFDP and South Africa. The main highlights of these reports are noted in the following paragraphs. The full reports are included as annexes to this report.

5.9 **Botswana** (Annex VII.1)

- The government formulated the National Policy on Disaster Management in 1996 to establish and maintain systems for dealing with actual or potential disasters that may occur in Botswana.
- Prior to this policy, the government had established the National Committee on Disaster Preparedness in 1993 and the National Disaster Management Office in 1998, located in the Office of the President. The cascade follows down to the village level where the Village Disaster Management Committees assume responsibilities for disaster management of the village level.
- Weather forecasting is the mandate of the Department of Meteorological Services, which integrates early warnings into public policy.
- The importance of early warning in disaster reduction has been recognized but emphasis is put on networking of various institutions to collect and analyze information in an effective way.
- More collaboration is needed between meteorological and hydrological services .
- No clear identity exists in issuing warnings and it is difficult to enforce this aspect of the work of the DMS.

Madagascar (Annex VII.2)

- The National Strategy on Disaster Risk Management in Madagascar was adopted in 2003. The Meteorological Service is prominently represented in the institutional framework and is connected to the National Disaster Risk Management Office.
- The improved severe weather forecasts have created better credibility for the Disaster Risk Reduction framework.
- Accuracy of the spatial distribution of extreme event forecasts, their intensity and impacts need to be improved.
- The warning system is too cyclonic oriented, whereas heavy rain, floods, flash floods, hailstorms, and drought also affect Madagascar.
- The window of opportunity after a disaster to better mainstream the Disaster Risk Management should be better utilized.
- Complementary tools provided by the SWFDP should be the beginning of an efficient way to facilitate the implementation of DRR strategy in Madagascar by improving accurate and timely warnings and forecasts.

Mozambique (Annex VII.3)

- The National Meteorological Service of Mozambique is supported by the government in the provision of early warnings and since the 2000 floods, the ability to cope with severe weather events has been steadily rising.
- The Service is responsible for the organization and supervision of early warning issuance, the effectiveness of which is highly dependent on coordination with disaster management, the water authorities and the media.
- The media is used by the meteorological, hydrological and disaster experts and managers to give interviews and press conferences on hazardous events.

- Workshops are given at the community level and in schools on how to interpret the forecasts and warnings.
- An organized and trained group is still required to lead the activities regarding severe weather events on a 24 hours and 7 day basis.

South Africa (Annex VII.4)

- The South African Weather Service Act contains the authority of the Weather Service to issue severe weather-related warnings over South Africa to ensure the single authoritarian voice in this regard.
- The Disaster Management Act of 2002 has been recognized as best practice and provides for integrated disaster risk management policy. The SAWS is involved in all phases of disaster risk management.
- For monitoring and forecasting of hazards, the SAWS has adopted a seamless forecasting system ranging from nowcasting through to extended range and seasonal forecasting.
- Officials from different forecasting offices at national and regional level are members of the national or provincial disaster management forums or committees and attend workshops on disaster management issues.
- Public awareness raising regarding severe weather hazards are carried out by all forecast offices. Ongoing communication with the stakeholders and face-to-face coordination is pursued. A problem area is the dual communication needs of the urban and rural areas where the needs and means of communication are different. In cases where there is uncertainty about the occurance of a hazard, the disaster community gets notified directly by the SAWS even though the media may not get the same information.
- SAWS is now more involved in risk and vulnerability assessment and the early warning systems have improved even though dissemination and proper reaction by communities still require more work.
- The guidance materials provided through the PWS Programme have helped the work of the SAWS especially as regards the establishment of a media strategy.

Tanzania (Annex VII.5)

- The Disaster Management operates under the Prime Minister's office and is responsible to develop adequate capacity for coordination for comprehensive disaster management among key players at all levels. The Act No 9 of 1990 regulates the Disaster Management activities.
- Integrated disaster management requires complex communication hardware, data acquisition and processing equipment to integrate and analyze the information for decision makers. This type of disaster mitigation system is not currently integrated in Tanzania, thus each type of disaster is managed by a separate command centre but does share information with other centres.
- During the past 20 years considerable progress has been made by Tanzania Meteorological and Hydrological Services in the provision and coordination of weather-related activities and in assisting local centres in improving weather services for the general public.
- There is a need to coordinate more effectively with the media.

Zimbabwe (Annex VII. 6)

- The Meteorological Service of Zimbabwe often convenes a discussion with the participation of weather experts, hydrologists and civil protection authorities following the notification of the government of a severe weather event. The media and especially the radio play a pivotal role in the dissemination of severe weather information. The relationship with the media requires continued attention to ensure the correct reporting of hazards in news headlines.
- The NMHS is actively involved in disaster management outreach programmes with the main objective of educating and assisting the rural communities to interpret meteorological information. Interpretation of probabilistic forecasts is a main task in such educational programmes.
- On the whole the timeliness, relevance, salience and credibility of the information have improved markedly since the commencement of the SWFDP in 2006.
- There is a need for closer collaboration between the meteorological and hydrological communities as well as with the neighbouring countries in cases of river flooding to ensure that the issue of run-off forecasts upstream is addressed properly.

5.10 The meeting agreed that the issue of obtaining feedback from the local communities affected by a hazard is of vital importance in the evaluation of the overall performance of the warning process and the coordination work.

5.11 The meeting stressed that a very clear measure of the success of the SWFDP would be the demonstration of the difference in the availability of the products and services since the start of the project and also following the current mid-term meeting. In this regard, the meeting was pleased to acknowledge that NMHSs were now more prepared to speak with confidence about the forecasts and warnings of severe weather than previously due to the better and more relevant products that they could have access to and use in the preparation of those forecasts.

5.12 The meeting noted with interest the example of community-operated raingauge from Barbados provided by SAWS.

5.13 With regards to communicating with the media, the meeting was informed of the media training workshops available through Met Office VCP. Further details can be obtained from the Met Office VCP Manager at steve.palmer@metoffice.gov.uk.

5.14 The meeting expressed very strong support for the continuation of the mode of operation of the SWFDP in its current format, namely the end-to-end-to-end warning and forecast system. This involves the forecast process of gathering observation, processing data, using NWP and other tools for the production of forecasts, dissemination and communication of those products to the user community and obtaining feedback from the users and stakholders, in particular the public, the disaster management and the media organizations. The meeting stressed that the success of the project was demonstrated through the way that the users of forecasts and warnings could be helped to make informed decisions to save people's lives and properties and contribute to the sustained national economic and social well-being.

5.15 The meeting applauded the fact that for the first time in the SWFDP RA I project the disaster management representatives were invited to join meteorologists from NMHSs to jointly discuss issues of common concerns. Recognizing the importance of hydrology, the Management Team agreed to the desirability of inviting

hydrologists to future meetings. The meeting felt that every effort should be made to maintain the format of similar future meetings through the participation of disaster management representatives as well as the media organizations.

5.16 The meeting also expressed the view that the future training sessions associated with this and other similar demonstration projects should include elements of training in communication, media relations and public education and outreach in addition to the use of new products made available through the NWP centres and RSMCs.

6 Other business

The meeting will consider any other business arising.

PRs represent the country…

7 Closing

The closure of the meeting is anticipated at 5:00 pm, 2 March 2007.

ANNEX I

AGENDA

1. **Opening**

2. **Organization**

   Approval of agenda
   Agreement of working arrangements

3. **Introduction to the Severe Weather Forecasting Demonstration Project (SWFDP)**

4. **Status of the Regional Subproject**

5. **Public Weather Services - Coordination between public weather service providers and disaster management**

6. **Other business**

7. **Closing**

****

ANNEX II

CBS Severe Weather Forecasting Demonstration Project (SWFDP)
Regional Subproject – South-eastern Africa

Regional Subproject Management Team

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Madagascar	S. Raveloarisoa
Mozambique	Helder Sueia
Tanzania	Philbert Tibaijuka
Zimbabwe	Hector Chikoore
RSMC Pretoria	Mnikeli Ndabambi (chair)
	Eugene Poolman (assistant to chair)
RSMC La Réunion	Yassine Kadri
ACMAD Niger	Zilore Mumba
Met Office (UK)	Ian Lisk
NCEP Africa Desk (U.S.A.)	Wassila Thiaw
ECMWF	David Richardson

ANNEX III

FINAL LIST OF PARTICIPANTS

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ANNEX IV

SWFDP IN RA I

Operational Forecasting Addresses and Phone/Fax Numbers (from abroad)

Met. Centre	e-mail	Phone number	Fax number
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RSMC La Reunion	rsmc_tcc.la_reunion@meteo.fr	+262 262 92 11 00	+262 262 92 11 48
Botswana	fforecasting@gov.bw	+267 391 41 75	+267 391 14 27
Madagascar	meteo@simicro.mg	+261 202 24 08 23 +261 202 24 07 75	+261 202 24 08 23
Mozambique	swfdp@inam.gov.mz	+258 21 49 01 48	+258 21 49 01 48
Tanzania	cfo@meteo.go.tz	+255 222 46 07 72	+255 222 46 07 72
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ANNEX V

COUNTRY REPORT FOR SEVERE WEATHER FORECASTING DEMOSTRATION PROJECT MANAGEMENT TEAM MEETING

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ANNEX V.1

REPORT ON WMO SWFDP IN BOTSWANA

1. Introduction

The participating National Meteorological and Hydrological Services (NMHS) were charged with the responsibility of ensuring that necessary telecommunications is in place for the reception of products from the Global and Regional Centres in their respective countries. Assess guidance from the Regional Specialized Meteorological Centre (RSMC) Pretoria and verify the efficiency of the forecast from NMHS by comparing it with the reality each time a severe weather event occurs.

2. The Field Phase of the Severe Weather Forecasting Demonstration Plan

The field phase of Severe Weather Forecasting Demonstration Project (SWFDP), RAI southeastern Africa officially began on the 6th November 2006 in Botswana as per the implementation plan. The report gives an overview of what transpired from the 6th November 2006 to date. The two officers who attended the preparatory training in Pretoria, South Africa conducted a workshop on the 8th November 2006 to brief weather forecasters on the interpretation and use of Numerical Weather Prediction (NWP) and EPS products for the purpose of common understanding and evaluation of forecasts. The presentation also touched on how to interpret and use the guidance from RSMC Pretoria.

3. Guidance from RSMC, Pretoria, South Africa

For the first few days after the commencement of SWFDP, the guidance was received through the email since the Website was not yet operational for graphic display of all GFS and Ensemble products. However, a few days on the line the guidance was posted in the Web site established by RSMC Pretoria. The guidance for day 1& 2 and day 3, 4& 5 were posted in Web site at 0900UTC and 1200UTC as per the agreement during the preparatory training. The guidance has been regularly updated throughout to date.

Global model-products are accessible through the RSMC Pretoria Web site which is linked to the participating global centers Web sites which includes ECMWF, NCEP, UK Met. Office and Africa LAM. The RSMC Pretoria Web site has been reliable enabling easy access to global models.

4. NCEP Products:

Africa Desk established a web site for graphical display of the NCEP GFS and ensemble forecasts for the support of the SWFDP. The NCEP GFS data for the SWFDP have been available via NCEP web site to the participating countries from the second week of the field phase to date.

5. ECMWF Products

A special web page was established by ECMWF for SWFDP, which could be accessed by the participating countries. NMHS has access to various products and charts that can be displayed as well.

6. Evaluation of Severe Weather Event

The purpose of evaluation is to validate the efficiency of the forecast issued by NMHS against the reality on the ground each time when a severe weather event occurs. To evaluate the guidance from RSMC Pretoria, thus its usefulness and the warnings/bulletins issued base on the guidance

6.1 Severe weather events in November/December 2006

About seven severe weather events occurred during the month of November 2006. Among the seven severe events, four storms were violent in nature, thus accompanied by strong damaging winds which blew away roofs of quite a number of building, uprooted trees and damaged power lines. The other four events were mainly associated with heavy precipitations from large scales system.

6.2 Strong winds due to convective activities:

The season rainfall for 2006/7, which started in October 2006 to date, has been drier than the normal years. This resulted in deficiency of rainfall over the country. This could be attributed to the existence of the El-Nino warm episode in the east Pacific. Despite the fact that there were less weather activities during this season, there was an increase in violent storms, which resulted in strong damaging winds. This has been a real challenge to forecasters. The products from the global and regional centres and guidance from RSMC Pretoria were not helpful in issuing warning of strong winds due to convective activities.

As mentioned earlier four severe weather events resulted in strong damaging winds over the eastern parts of the country. The GFS products from global and regional centres and guidance were unable to pick the strong winds associated with the violent storms. The storms were localized and small in size but distractive in nature where roofs of houses were blown away, trees uprooted and power lines were damaged. The values of traditional severe storm indices were the only solutions to the problem, such as the CAPE, Lifted and etc. Out of four events one storm was picked by the global and regional models including the guidance in short term. The guidance was going for heavy precipitation but failed to pick the strong winds. During that particular event the guidance was helpful for heavy precipitation in short-term although the most significant event was the strong winds instead of heavy rainfall that was anticipated. The strong winds caused a substantial damaged to property. Two towns and a village in the eastern parts of the country experienced an ordeal of strong winds which blew the roofs of houses, uprooted trees and damaged power lines. It was realized that forecasting strong winds due to convection is very difficult because mostly the phenomena is small in size and can not be identified in large

scale systems. The upper air information is likely to be one of the solutions to the problem in the short term.

The storms associated with strong winds develop very rapidly that advance warning is at times not possible. For example, at 1200UTC, on the 13th November 2006, Gaborone (Capital City) sounding revealed additional clues regarding the potential for severe storms over the eastern parts of the country. In particular, note the strong vertical wind shear (rate of change in wind speed with height) in the lower level, refer to the graph below (Fig.1).

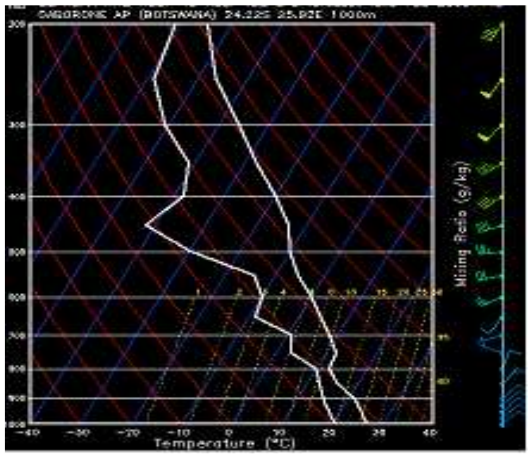


Figure 1: Tephigram analysis at 12Z, Gaborone

The winds quickly increased from 10knots at ground level, averaging around 50 knots through a deep 100mb layer. There is also some turning of wind (helicity) seen as northeasterly surface winds quickly became southwesterly. The presence of a strong winds shear near the surface and through a deep layer indicated a high potential for strong wind damage from convective storms. The area under a curve, CAPE (1590KJ), is relatively large. The lifted index, LI=-6 also indicated a relatively higher level of instability. This resulted in strong a damaging wind, which was preceded by heavy precipitation. Three kinds of such storms were experienced in the country leaving two towns and a village in the eastern parts of the country traumatized by severe storms. These storms occurred late in the afternoon between 1300UTC and 1500UTC.

6.3 Heavy precipitation due convection

Occasional heavy precipitation from lager scale system has been experienced over the country. The guidance was helpful both in the short and long term. In most cases the daily guidance from RSMC Pretoria was spot on although in most of the time the guidance was over estimating the precipitation just like the global and the regional models. This has led to false alarm. However, in the short term it has improved severe weather forecast especially for the heavy precipitation even though there were no floods experienced due to the fact that it has been dry throughout due deficiency in rainfall. In general the guidance and the products from the models have improved the forecast both in the short and long term.

The working relation with the civil protection agency has been in existence for quite some time to dates. The NMC and civil protection agency both acknowledges that our working relationship need to be improved and also bring on board other

organs who has a role to play in weather related disaster issues. The civil protection agency needs short and long term forecast for severe storms with good accuracy for a specific location and time. In this regard the guidance and the products from global and regional centres have improved the quality and accuracy of the weather forecasts.

7. Lesson Learned:

- It still remains difficult to predict strong winds due to convective activities.
- Upper air information is essential for severe storm forecasting especially for the strong winds.
- Critical values of traditional severe storm indices are vital to forecast severe storms.
- The presence of the 200hPa divergence is crucial for severe storm development.
- Vertical wind shear is crucial in the development of severe storm.

8. SWFDP Beyond November 2007

There are several aspects that need not to be terminating which includes all the special products that are provided by the global and regional centres to support the SWFDP. It will be pre-mature to terminate these products beyond November 2007 because they have improved the timing of weather forecasts. The provision 6 hourly EPS products (i.e EPSgrams, critical values of traditional severe storm indices have improved the quality of the weather forecast. Botswana would like to continue using or experiment further with the products beyond SWFDP and give feedback to Global and regional centers on whatever product that need to be improved.

The guidance from RSMC Pretoria is helpful and would like to continue with it beyond November 2007 because it gives summary of the weather in the short and long term and helps the forecasters to pay attention to certain aspects of the weather.

ANNEX V.2

REPORT ON WMO SWFDP IN MADAGASCAR

1) We are receiving the daily guidance products via RSMC Pretoria e-mail and website but sometins we are ubable to jet the products because of the slow speed of internet connectivity and problem of connectivity itself.

2) We are receiving the daily guidance products every day . both the short-term and medium term.

3) Yes RSMC Pretoria guidance product is useful necessarely.It is exactly used as a forecast.it's probabilityis high.Generally it is timely for our forecasting process but it willhave been better if we could get the products by around 06.00 am (GMT) We are able to receive the daily emails but not always available due to the slow speed and the problem of internet connectivity. Heavy précipitation – Strong wind and severe convection are good.

4) a – Yes, we are accessing the various products within context of the SWFDP from the other Centre.
b – Charts frequently used because they are useful tools :
– ECMWF : Extrem Index – Charts probabilities wind – Precipitations - MSLP – Temperature – EPSgram (Ensemble Prediction Severe Weather) wich give ten days forecast of cloud cover - Précipitations – surface wind – Variation of températures
– MetOffice UK and RSMC La Réunion : forecast of tropical cyclone track.
– NCEP : Forecast of Total Rainfall in 6 hours during five days.

5) We are able to display those charts or products for our warning programme on screen during the weather briefing.

6) SWFDP has improved severe weather forcasting very well : about floods in our country, it was forecasted in advance the precision of the warning was very high especially in Antananarivo : consequently, the number loss of life was reduced (seven death only during the disaster)

7) Yes, all forecasters at our NMC are able to use the various products especially the daily guidance from RSMC Pretoria.

8) Our centre has sent sometimes the evaluation forms for some incident of severe weather to RSMC Pretoria but in some cases we failed because of the problem of internet connectivity.

9) Yes, we are actively coordinating with our civil protection agency – (B.N.G.R.C.N). Precipitation and floods, cyclonic informations are required by them.
SWFDP has helped in reducing preparedness

10) Our service wants to have implemented operationally :
- Total rainfall forecast for 5 days (NCEP) ,
- Tropical cyclone (MetOffice UK/RSMC La Réunion)
- Charts probabilities wind and rainfall – EPSgram (ECMWF)
- Severe weather (RSMC Pretoria).

N.B. : Rainfall during December 2006 up to 16 February 2007 is shown below

RAINFALLS IN MADAGASCAR
From December 2006 to 16 February 2007

Stations	December 2006 (mm)	Normal (mm)	P (%)	Obs.	January 2007 (mm)	Normal (mm)	P (%)	Obs.	February 2007 (mm)	Normal 1ère+2ème decade (mm)	P (%)	Obs.
ANTSIRANANA	564.9	153.3	368	**Excé**	227.3	320.7	71	Défic	90.3	237.8	40	Défic.
NOSY-BE	276.0	321.3	86	*Norm*	153.0	503.7	30	Défic	251.3	285.5	88	*Norm.*
ANTSOHIHY	183.0	238.8	77	*Norm*	277.9	416.5	67	Défic	429.7	285.0	151	**Excé.**
SAMBAVA	546.1	197.3	277	**Excé**	179.9	298.1	60	Défic	48.1	182.9	26	Défic.
ANTALAHA	884.3	225.1	393	**Excé**	259.8	315.4	82	**Norm**	92.4	224.9	41	Défic.
MAHAJANGA	292.8	248.2	118	*Norm*	344.9	439.1	79	*Norm*	380.8	292.9	130	**Excé**
BESALAMPY	329.7	185.3	178	**Excé**	736.3	380.1	194	**Excé**	302.7	348.5	87	*Norm.*
MAEVATANANA	141.0	256.8	55	Défic	715.7	389.1	184	**Excé**		318.9		
AMBOHITSILAOZANA	62.6	192.7	32	Défic	543.6	281.8	193	**Excé**	237.9	185.6	128	**Excé**
SAINTE-MARIE	278.7	271.7	103	*Norm*	601.4	424.0	142	**Excé**	307.9	334.1	92	*Norm.*
MAINTIRANO	185.2	181.3	102	*Norm*	1156.1	328.8	352	**Excé**	317.2	274.2	116	*Norm.*
IVATO	228.9	279.1	82	*Norm*	543.3	322.0	169	**Excé**	312.0	230.1	136	**Excé**
ANTANANARIVO	208.5	241.5	86	*Norm*	442.3	304.4	145	**Excé**	273.0	213.1	128	**Excé**
TOAMASINA	443.6	317.8	140	**Excé**	716.8	403.6	178	**Excé**	258.1	316.3	82	*Norm.*
ANTSIRABE	266.2	220.4	121	*Norm*	659.6	262.2	251	**Excé**	126.8	163.8	77	*Norm.*
MORONDAVA	155.1	122.4	127	**Excé**	811.9	278.3	292	**Excé**	200.9	168.2	119	*Norm.*
MOROMBE	32.4	108.8	30	Défic	330.6	119.4	277	**Excé**	61.5	79.5	77	*Norm.*
FIANARANTSOA		217.4			376.5	224.4	168	**Excé**	196.9	170.1	116	*Norm.*
MANANJARY					845.4	302.6	279	**Excé**		316.4		
RANOHIRA	332.8	194.7	171	**Excé**	378.0	212.9	176	**Excé**	147.5	135.1	109	*Norm.*
FARAFANGANA					345.4	294.3	117	*Norm*		208.3		
TOLIARA	28.8	76.6	38	Défic	288.6	89.9	321	**Excé**	22.6	60.2	38	Défic.
TAOLAGNARO	70.8	152.4	46	Défic	190.4	186.7	102	*Norm*	135.1	136.5	99	*Norm.*

ANNEX V.3

REPORT ON WMO SWFDP IN MOZAMBIQUE

1. Introduction

The National Institute of Meteorology in Mozambique (INAM) is one of the National Meteorological Centres (NMCs) participating in the SWFDP Regional Subproject for RA1.

The following report provides an overview on the status of the Severe Weather Forecasting Demonstration Project Implementation in Mozambique. The report will mainly focus on six aspects which are discussed below:

2. Data Access

The technical capacities in place at INAM do allow access to the various products made available by the Global Centres participating in the project. In the scope of the project the products are accessed via internet. Obviously, sometimes the internet connectivity does not allow a rapid downloading of some of the products; the guidance products from RSMC – Pretoria are received by emails as well as by accessing the RSMC – Pretoria website. Although we had agreed in Pretoria (training) to have the products available at our NMCs by 08:00 UTC, sometimes this appears not feasible.

3. Usefulness of Guidance Products

The guidance products provided by RSMC – Pretoria have proved to be very useful. In fact, most of the times when the guidance agrees with our forecasting it boost the forecaster's confidence. Nevertheless, there were times that the guidance products did not pick the heavy rains as it happened in Quelimane on the night of 20th January when over 300 mm/24hrs was reported (see ANNEX A).

4. Improvement on the Severe Weather Forecasting

There is no doubt that the SWFDP has contributed a lot on improving the Severe Weather Forecasting at our NMC. Through the SWFDP, many products that were not used before have now become part of our daily forecasting process. We can mention here the various indices (Lifted Index, K – Index and others).

5. Evaluation Forms

Although INAM has never submitted any evaluation form within the scope of the Project, evaluations are being carried within the Forecasting group. The main reason behind it is the lack of coordination with the NWP group, since it is our aim to have this group directly involved in the evaluation process.

6. Warning Bulletins for DMCPA

Whenever a severe weather event is forecasted warning bulletins are issued and made available to the Disaster Management Institute. INAM has a very effective collaboration with DMCPA. And within this collaboration INAM has three meteorologists attached to the National Centre for Emergency Operations ran by INGC, where daily briefings on weather conditions are conducted by INAM personnel.

7. Outstanding Problems in the Implementation of the SWFDP

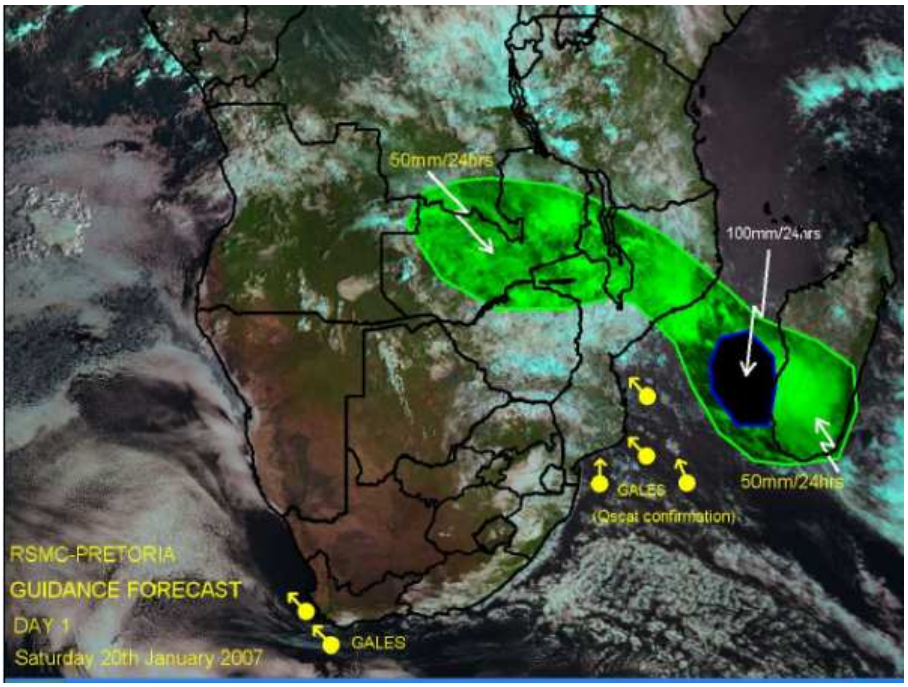
The main problem arising from the SWFDP is the lack of training in the field of NWP interpretation mainly in regard to the Severe Weather Indices.

Mozambique has participated in the Preparatory Training provided in Pretoria with two meteorologists and very soon one of them will be participating in a training program provided by the African Desk at NOAA. It is our hope that after this training at NOAA the capacities of our staff in the use of the various products available will be enhanced.

8. The Way Forward

As it was mentioned before the SWFDP has proved to be useful and for that reason in our view some aspects should continue even after the Project termination. The Global centres involved in this project should continue to make their products available to the NMCs. The same should be with the guidance products issued by the RSMCs. And lastly a very important aspect is the need for more training.

ANNEX A


50mm/24hrs
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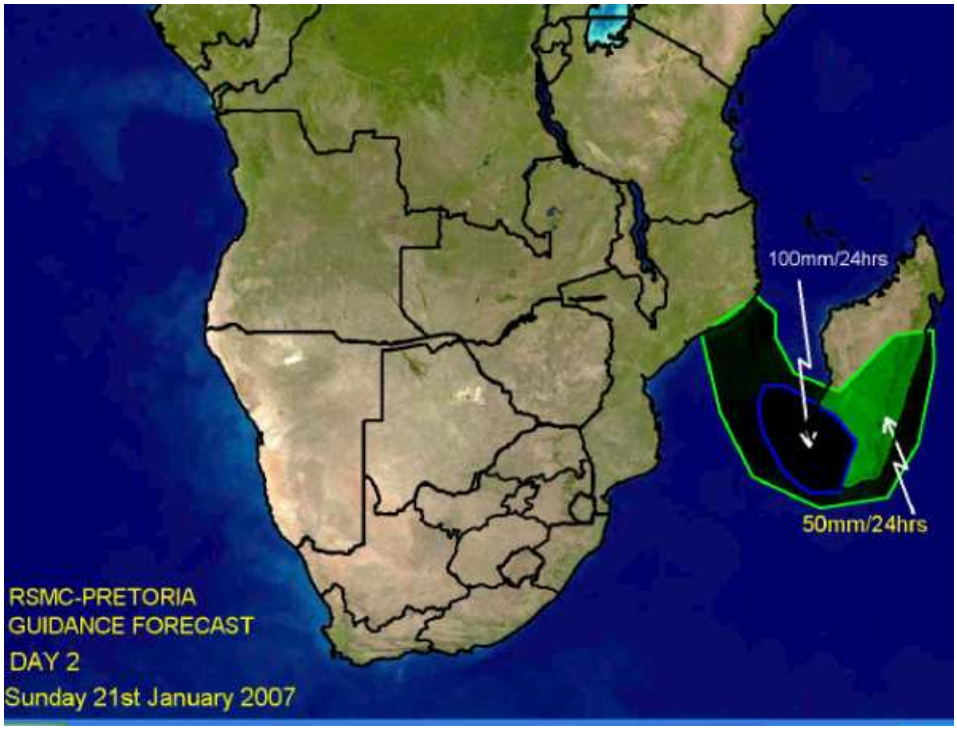
GALES
(Qscat confirmation)
RSMC-PRETORIA
GUIDANCE FORECAST
DAY 1
Saturday 20th January 2007
GALES


100mm/24hrs
50mm/24hrs
RSMC-PRETORIA
GUIDANCE FORECAST
DAY 2
Sunday 21st January 2007

ANNEX V.4

REPORT ON WMO SWFDP IN TANZANIA

The daily guidance products from RSMC website are obtained on daily basis, but on few occasion we are unable to get the products because of the slow speed of internet connectivity. Both guidance products on short and medium term are available on daily basis.

The RSMC Pretoria guidance products is useful to a great extent except for events which happen for a very short period e.g. strong wind due to thunderstorms or water spouts over Lake Victoria which cannot be monitored by satellite pictures. The products have enabled us to locate areas with a high probability of floods and warnings are sent to those areas well in advance through media (radio or TV). The information is sent once in a day after the afternoon weather conference and it is broadcasted in the evening hours. We feel that the products do not reach the intended population on time. There is a need to improve our communication link to the media and in addition there is a need to sensitize them to broadcast severe events whenever they receive them. Currently they are not doing so.

The guidance in generally timely for our forecast process but it will have been better if we could get the products by around 10.00 am. Daily email is not always available due to the problem of internet connectivity and slow speed. We can assess RSMC website and the products are very useful for our forecasting process. We conducted a seminar on how to access and use all the products from RSMC and from other centres and most of the meteorologists are now conversant on how to access ad use them. They are interested in the analysis of model outputs of upper air ascents, METGRAMS, EPSGRAMS from ECMWF and NCEP. There is a tendency for most models to undestimate rainfall in particular over the coastal areas.

We are generally accessing products from other centres on daily basis and they are useful in our daily forecast. We are also running our localized model WRF model initial data and we compare with forecasts from other centres.

We frequently use, METGRAMS, EPSGRAMS, TQ grams and precipitation forecasts because they are useful tools in forecasting in our country.

So far most products from deterministic forecast have shown their potential in assisting us at weather forecast as they show signals of the areas potential for weather activities.

The products are normally displayed using a power point presentation during weather conference which is normally held in the afternoon. The SWFDP has greatly improved forecasting of floods but not so much for the forecasting of sporadic strong winds, because they are on micro-scale.

In most cases models do not pick meso-scale features

Currently we do not have a radar and hence we cannot monitor sporadic events. It becomes useful in forecasting winds only in the case of an approaching tropical cyclone. The forecast e.g. of floods is normally sent 24 hours in advance and it has been noted to have a hit of about 60%.

Some of the major events have been sent to RSMC Pretoria by filling the evaluation form but in some cases we failed because of the break down of internet. Risk tables, probability tables and discussion is quite useful. Sometimes products updates are late. We could have reported more severe events if the criteria for reporting was well defined especially on rainfall amounts. We normally archive all the events for future reference.

Most of the severe events are reported to the Prime Ministers Office in the Department of Disaster Management and to the public using radio and TV. We reported the impact of tropical Cyclone Bondo on daily basis to Prime Ministers Office and to the public through radio and TV and this was useful for marine vessels, fishermen and people leaving on the coastal belt. In this aspect SWFDP helped us in tracking the movement,rainfall intensity and strong winds due to the tropical cyclone Bondo.

An example of floods which occurred in the city of Dar-es salaam on 29th December 2006 is attached.

ANNEX V.4

REPORT ON WMO SWFDP IN ZIMBABWE

1. INTRODUCTION

The Meteorological Services Department of Zimbabwe is one of the 5 National Meteorological Centers (NMCs) participating in the SWFDP regional subproject for RA1 southeast Africa. The Service is pleased to report the record of positive success attained so far with regards the implementation of SWFDP since it commenced in November 2006.

Following the pre-project training held in Pretoria in October 2006, there was an intensive cascading process to train other weather forecasters in the center who did not attend the pre-project training. Forecasters were trained to use the new products which became available as a result of the regional sub project. EPSgrams and forecast Tephigrams were definitely new as well as 6-hourly products. Forecasters were also appraised of the implementation plan of the SWFDP as they play a key role in the success of the project. In addition, a senior forecaster in the Service was seconded to the African Center for Meteorological Applications for Development (ACMAD) in Niger specifically for the SWFDP.

Since the commencement of the SWFDP, there have been about 23 severe weather events (as at 21 February 2007) mainly in the form of heavy precipitation events (see Annex A). The most notable event occurred at New Year's Day with precipitation amounts exceeding 100 mm in 24 hours for some stations. It is most pleasing to note that this event was well forecast by most models some 7 days in advance such that there was adequate lead-time for alerts and advisories to be communicated to the press and disaster management and civil protection authorities. The risk of flooding was reduced by the fact that this event was preceded by an extended period of dry weather lasting up to two weeks and therefore the soils were dry and the river flows very low in low altitude and flood prone areas. However, there were localised floods associated with this event in some areas and some villagers were reported in the local press to have been marooned on an island.

The guidance products that are available have been most useful with regards heavy precipitation events since the wind regime over Zimbabwe is generally weak throughout the year except in rare cases of Tropical Cyclones and severe storms.

2. STATUS OF IMPLEMENTATION

2.1 Observations

In any forecast process, observations come first and foremost. Before a forecaster can gain confidence in any model guidance, the analysis should agree with observations. Surface observations from the southern Africa region and the adjacent oceans have been consistently transmitted via the GTS and have been available to the Meteorological Service of Zimbabwe on time for the forecast process. Unfortunately, upper air observations are very scant over the subcontinent apart from a few observations over South Africa.

Satellite observations have been available regularly from Meteosat for both 0° and 63°E. However, the weather radar network fo r Zimbabwe is broken down

having direct implications particularly to aviation forecasting. Weather radars are an integral part of the forecast process and are critical for nowcasts especially in cases of frozen precipitation and hailstorms.

2.2 Access to model guidance

Most models have been updated on time for the normal forecast process since the commencement of the SWFDP. However, telecommunications have been a major obstacle to the implementation of the regional subproject. The slow Internet connection has increased the download time for products and therefore forecasters rarely download all guidance available for limitations of time. This problem is internal to the center and efforts are being made to upgrade the system to broadband or satellite connection. Frequent power blackouts also cause considerable disruptions to the forecast process.

2.3 Usefulness of Guidance products

In addition to the numerical guidance products that Zimbabwe Meteorological Services had, the new range of products that were made available by the SWFDP has proven very useful for a number of purposes some of which are outside the scope of SWFDP.

The South African Weather Service (SAWS) Regional Specialised Meteorological Center (RSMC) severe weather guidance has been very good for the most part. RSMC Pretoria synthesises the guidance products and produces a map of likely areas to be affected by heavy precipitation and/or strong winds. There are few cases however, when the guidance has been late for the forecast process as in the case of Tropical Cyclone Favio.

The guidance from RSMC La Reunion on Tropical Cyclones intensity and track has been very useful. The new products on the SWFDP also give more confidence on cyclone tracks. Previously, forecasters relied more on persistence and there was low confidence in the forecast track such that civil protection and disaster management authorities did not get adequate information on which areas would be most affected by a cyclone or a storm.

Zimbabwe Meteorological Services also note that most models available on the SWFDP are on a number of occasions unable to pick localised heavy precipitation events (i.e. events with > 50 mm of rainfall in 24 hours). The models underestimate precipitation nearly all the time. This may be attributed to the coarse horizontal resolution of the global models as well as the convective nature and therefore high variability of tropical precipitation.

The NCEP model exhibits the least skill whilst, ECMWF products have proven the most reliable for Zimbabwe and as a result the most trusted and most used in the forecast process. ECMWF EPSgrams provide very good guidance for onset and cessation of a severe weather event and are normally consistent. The EPSgrams are one of the most useful tools of the SWFDP.

There are several unfortunate cases when the guidance has ‘broken down’ with 1 or 2 days to the severe weather event, just when they are needed most. In such cases the models have not only differed considerably, they have also changed the predictions significantly. It is then that the local experience of forecasters has been very relevant. A chart discussion is held every day at 11am to discuss the observations and model guidance and a consensus forecast is issued. The forecasters also account for the climatology and local factors such as orographic effects. A combination of the various guidance and local experience has proven formidable.

On the whole, despite the limitations of some of the products, the Meteorological Department of Zimbabwe notes a great leap forward in terms of severe weather forecasting and weather forecasting in general.

3. PROJECT EVALUATION

The Meteorological Department of Zimbabwe has submitted all severe weather evaluation forms through the SWFDP website in accordance with the implementation plan. Below are a few comments with regards the project evaluation against the main goals of the SWFDP:-

SWFDP GOAL	NOTES
To impove the ability of NMCs to forecast severe weather events	A great improvement is noted by Zimbabwe in this regard. There is even increased confidence is storm/cyclone tracks.
To improve the lead time of alerting these events	The forecast lead time has improved remarkably
To improve interaction of NMCs with Disaster Management and Civil Protection Authorities before and during events	There has been more contact with the Zimbabwe National Water Authority and the Department of Civil Protection since the commencement of the SWFDP. The center has received positive feedback from these authorities.
To identify gaps and areas for improvements	A number of areas that need improvement have been identified and efforts are being made to improve them. This process is ongoing.
To improve the skill of products from GDPFS centers through feedback from NMCs	Feedback is being provided regularly through the evaluation forms and email postings to the project website. Most notably, models are underestimating tropical convective precipitation. This process is ongoing.

4. BEYOND THE SWFDP

Whilst cognisant of the fact that the commitment of the global meteorological centers is only up to the end of the SWFDP in November 2007, there are quite a number of products which the Meteorological Service of Zimbabwe would not do without. A summary of the most crucial products is given below and it would be desirable for them to be made available beyond the demonstration project.

EPSgrams and 6-hourly time steps are definitely very important, and as indicated above, the most useful products of the SWFDP. Model outputs of meteorological parameters at 6-hourly time steps have transformed forecasting at Zimbabwe Meteorological Services. Forecasters are now able to give the precise timing of expected weather to within hours, something which was not possible earlier.

It is also hoped that the guidance of the regional centers RSMC Pretoria and RSMC La Reunion would continue. The short and medium range maps, risk tables and discussions of RSMC Pretoria are very useful.

The positive feedback that the Meteorological Department of Zimbabwe has received from various stakeholders including Government, Civil Protection authorities and the public can only be attributed to the Department's participation in the SWFDP.

ANNEX A

NO.	DATE	EVENT	LOCATION	AMOUNT (MM)	WAS THE EVENT FORECAST?	COMMENTS
1	14/11/2006	HEAVY RAINFALL	RUSAPE	69.4	YES	Rain was forecast although expected amounts were low.
2	18/11/2006	HEAVY RAINFALL	KWEKWE GWERU BULAWAYO	55.7 135.8 105.0	YES	Expected rains were about 80mm.
3	25/11/2006	HEAVY RAINFALL	MVURWI	69.6	YES	Low amounts of about 20mm were expected.
4	10/12/2006	HEAVY RAINFALL	GOKWE CHIVHU MASVINGO	63.7 82.0 50.1	YES	Low amounts of about 20mm were expected.
5	11/12/2006	HEAVY RAINFALL	CHINHOYI SEKE WARREN PARK ASHDOWN PARK	59.0 60.6 56.5 92.4	YES	Low amounts of about 20mm were expected.
6	17/12/2006	HEAVY RAINFALL	HARARE AIRPORT	57.5	YES	Low amounts of about 20mm were expected.
7	18/12/2006	HEAVY RAINFALL	KEZI	52.1	YES	Low amounts of about 20mm were expected.
8	25/12/2006	HEAVY RAINFALL	BINGA	65.7	YES	Low amounts of about 20mm were expected.
9	27/12/2006	HEAVY RAINFALL	GOKWE HARARE AIRPORT	84.9 56.0	YES	Low amounts of about 20mm were expected.
10	30/12/2006	HEAVY RAINFALL	KEZI	111.7	YES	Warning for heavy rains had been issued.
11	31/12/2006	HEAVY RAINFALL	BINGA GOKWE KWEKWE GWERU MASVINGO B. BRIDGE	96.1 78.0 68.3 51.4 60.7 93.2	YES	Low amounts of about 20mm were expected.
12	01/01/2007	HEAVY RAINFALL	V. FALLS MVURWI	58.2 61.8	YES	Low amounts of about 20mm were expected.
13	05/01/2007	HEAVY	MVURWI	68.2	YES	Low amounts

		RAINFALL				of about 20mm were expected.
14	15/01/2007	HEAVY RAINFALL	MVURWI	56.7	YES	Low amounts of about 20mm were expected.
15	16/01/2007	HEAVY RAINFALL	CHINHOYI	55.2	YES	Low amounts of about 20mm were expected.
16	20/01/2007	HEAVY RAINFALL	KARIBA KAROI CHINHOYI	53.9 59.8 52.6	YES	Low amounts of about 20mm were expected.
17	24/01/2007	HEAVY RAINFALL	KARIBA	74.0	YES	Low amounts of about 20mm were expected.
18	29/01/2007	HEAVY RAINFALL	BINGA CHINHOYI	65.4 55.7	YES	Warning issued to the national press for widespread rains country wide expected for the next week.
19	30/01/2007	HEAVY RAINFALL	MUTOKO	107.3	YES	Covered by above statement.
20	07/02/2007	HEAVY RAINFALL	KADOMA	59.9	YES	Low amounts of about 20mm were
21	12/02/2007	HEAVY RAINFALL	KAROI	56.2	YES	Low amounts of about 20mm were expected.
22	13/02/2007	HEAVY RAINFALL	RUSAPE	60.3	YES	Low amounts of about 20mm were expected.
23	19/02/2007	HEAVY RAINFALL	MUTARE CHIREDZI ZAKA RUSAPE	127 101 78 61	YES	RSMC guidance was very accurate. Unfortunately a junior Forecaster was unable to issue the relevant warnings ands advisories.

ANNEX VI

STATUS OF THE REGIONAL SUBPROJECT

PERIOD: 6 November 2006 – 28 February 2007
NMS:

1. HIGHLIGHTS OVER THE PERIOD

2. OVERVIEW OF PRODUCTS

a. Usefulness of RSMC-Pretoria guidance
b. Usefulness of SWFDP NWP/EPS Products received from each global centre and RSMC UM-SA12

3. PROJECT EVALUATION AGAINST SWFDP GOALS

SWFDP GOAL	IMPACT
To improve the ability of NMCs to forecast severe weather events	
To improve the lead time of alerting these events	
To improve the interaction of NMCs with Disaster Management and Civil Protection authorities before, during and after severe weather events	
To identify gaps and areas for improvements	
To improve the skill of products from Global Centres through feedback from NMCs	

4. EVALUATION OF WEATHER WARNINGS (feedback from customer?, standardized questions to disaster authorities?)

5. SUMMARY (general comments, challenges, etc, details in Annex 1)

6. CASE STUDY (PowerPoint Presentation to include guidance products (RSMC and NWP), satellite imagery, warnings issued, impact evidence etc)

ANNEX VI.1

Evaluation Table

DATE	SWFDP Evaluation Form Event Nr (If Applicable)	Weather Type	Location	Observed amount (rainfall or wind speed)	RSMC Guidance		Which NWP/EPS forecast product(s) used by NMC	Local Warnings issued	Impact
Dd/mm/yy		Mesoscale rainfall or synoptic scale rainfall or strong winds (covective or synoptic)		(mm/period or KTS)	Amount predicted	Usefulness (1-4) 4 is best	List by centre		

ANNEX VII

COUNTRY REPORT FOR SEVERE WEATHER FORECASTING DEMOSTRATION PROJECT MANAGEMENT TEAM MEETING MAPUTO, MOZAMBIQUE, 1-2 MARCH 2007

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ANNEX VII.1

BOTSWANA

DISASTER RISK REDUCTION ORGANISATION IN BOTSWANA WITH PARTICULAR REFERENCE TO WEATHER RELATED EARLY WARNING.

1 INTRODUCTION

1.1 This paper presents background of Disasters in Botswana, policy framework, institutional framework, and status of weather related early warning in Botswana.

1.2 A number of international events, including the International Decade for Natural Disaster Reduction, Agenda 21 and the World Summit on Sustainable Development, have marked and signify growing concern with early warning for disaster reduction. The second International Conference on Early Warning was part of the ongoing process of the 1994 Yokahama Strategy for a Safer World. These are part of the processes based on the first International Conference on Early Warning that was held in 1998, the end on International Decade for Natural Disaster Reduction Geneva Programme Forum in 1999, and the 2002 World Summit on Sustainable Development, aimed at supporting the development of early warning at the international level.

1.3 The second International Conference on Early Warning that was held in Bonn, Germany examined issues relating to the integration of early warning into public policy to help enhance the practice of early warning worldwide and improve its effectiveness in disaster risk reduction.

2 BACKGROUND

2.1 Botswana is vulnerable to a number of disasters, principally drought, floods, veldfires, pest infestations, epidemics, animal diseases, severe weather, transport accidents, refugee influxes, industrial explosions, structural fires, industrial explosions and HIV/AIDS. Drought is a frequent phenomenon countrywide and major droughts occurred in the 1980's. Floods occasionally occur during the rainy season, which runs from October to March. The 1999/2000 floods were the worst in living memory. They affected twenty-eight administrative Districts/cities, town/villages, that is, almost the entire country which comprises thirty Districts. Thirteen lives were lost.

3. POLICY FRAMEWORK

3.1 In 1996, the government formulated the National Policy on Disaster Management in recognition of the following;

(i) Botswana was vulnerable to other disasters other than drought.
(ii) A cost effective Disaster Management programme should as far as possible use existing resources and capacity
(iii) The Disaster Management Programme should be consistent with development objectives of government.
(iv) The programmme should deal with Disaster Management comprehensively and ensure that such activities are implemented within local and national development context.

3.2 The objective of the Policy, interalia, is to establish and maintain systems for dealing with actual or potential disasters that may occur in Botswana.

4. INSTITUTIONAL FRAMEWORK

4.1 NATIONAL COMMITTEE ON DISASTER MANAGEMENT

4.1.1 Following the United Nations International Decade for Natural Disaster Reduction, the government established the National committee on Disaster Preparedness in 1993. This Committee was later renamed National Committee on Disaster Management. Its mandate was;

(i) To increase coordination and improve effectiveness in the management of disasters.
(ii) To ensure cost effectiveness in the utilization of resources in the management of disasters.

4.1.2 The Committee is chaired by the Deputy Permanent Secretary (Development) in the Office of the President and is composed of some Deputy Permanent Secretaries, Botswana Red Cross. UNDP, BDF, and Botswana Police Service.

4.2 In addition, multi-sectoral preparedness committees were formed in the Districts. Some structures also exist within Ministries to deal with sectoral disasters.

4.3 In order to mitigate disasters, the National Disaster Management Office (NDMO) was established in 1998. The NDMO, located in the Office of the President, coordinates disaster management in Botswana.

4.4 NATIONAL DISASTER MANAGEMENT TECHNICAL COMMITEE (NDMTC)

4.4.1 The NDMTC is a multi-sectoral technical advisory body composed of subject matter specialists from stakeholders represented in the NCDM. The Director, NDMO, chairs the Committee.

4.5 DISTRICT DISASTER MANAGEMENT COMMITEE (DDMC)

4.5.1 DDMCs are formed by each City/town and District to oversee implementation of disaster management in the Districts. The Committee comprises of all Government Departments and other organizations based in the Districts. The primary responsibility of the DDMCs is to implement disaster risk reduction in the Districts.

4.6 VILLAGE DISASTER MANAGEMENT COMMITEE

4.6.1 Village Disaster Management Committees assume responsibilities for disaster management at the village level.

5. NATIONAL DISASTER RELIEF FUND

5.1 The NDRF was established in 1996, it is administered by NDMO. Its purpose is to provide assistance to disaster victims by meeting their life sustaining needs such as shelter, food and provision of sanitary facilities.

6. IMPORTANCE OF EARLY WARNING

6.1 Early warning has the potential to contribute significantly to reducing current and future disaster losses as an important non-structural component of disaster risk reduction. Networks of various institutions undertake systematic information collection and analysis together in a collective effort to generate information to help prevent likely disaster events from occurring or to reduce their outcomes.

6.2 Risk assessment is the starting point and context for identifying risks by determining situations in which conditions for a particular type of disaster exist while early warnings are the interpretations and projections that the outbreak of disaster in a high risk situation is likely and imminent. Warning helps provide the knowledge to identify impending risks, determine their levels and potential impacts, both in terms people and locations, and guide actions to avoid, reduce or mitigate the effects of those risks when they occur. Early warning is one of the cost effective mitigation interventions of disaster risk reduction in Botswana.

7. ORGANISED WEATHER RELATED EARLY WARNING IN BOTSWANA

7.1 Weather forecasting in Botswana is the mandate of the Department of Meteorological Services. The department among others integrates early warning into public policy and improves its effectiveness in disaster risk reduction. So far Progress has been made in boosting the scientific basis and technological aspects of weather related early warning in Botswana, but progress in integrating forecasting in effective risk management needs to be further improved.

7.2 Efforts have began to rectify the situation of excessive focus on the details of warning message design, dissemination and response, without adequate attention to necessary processes for achieving the multi-organisational change, cooperation and multi-stakeholder interaction needed to make warning messages more effective.

7.3 Plans are underway to develop multi hazard early warning system. The National Disaster Management Office is in the process of carrying out a Hazard

Identification, Risk and Vulnerability Assessment Study that would identify risks by determining situations in which conditions for a particular type of disaster exist. NDMO is also carrying the needs analysis for the National Disaster Management System that would subsequently pave way for the system. The system would strengthen the early warning system and enhance multi-stakeholder interaction and cooperation.

8. CONCLUSION

8.1 All in all the importance of early warning as a cost effective way of reducing current and future disaster losses cannot be over emphasized. However, emphasis is on networking of various institutions in order to undertake systematic information collection and analysis together in a collective effort. This helps in disseminating reliable early warning information that would not duplicate the efforts of other stakeholders and confuse the end users.

8.2 Coordinated effort with other stakeholders will help:

(i) Provide information that is easily accessible and understandable

(ii) Better utilize, integrate and extend existing warning services

(iii) Enable effective decision making by individuals and agencies through translating technical information that can enable any member of community to take appropriate action.

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ANNEX VII.2

MADAGASCAR

COORDINATION BETWEEN METEOROLOGICAL SERVICE OF MADAGSACAR AND DISASTER MANAGEMENT AUTHORITIES

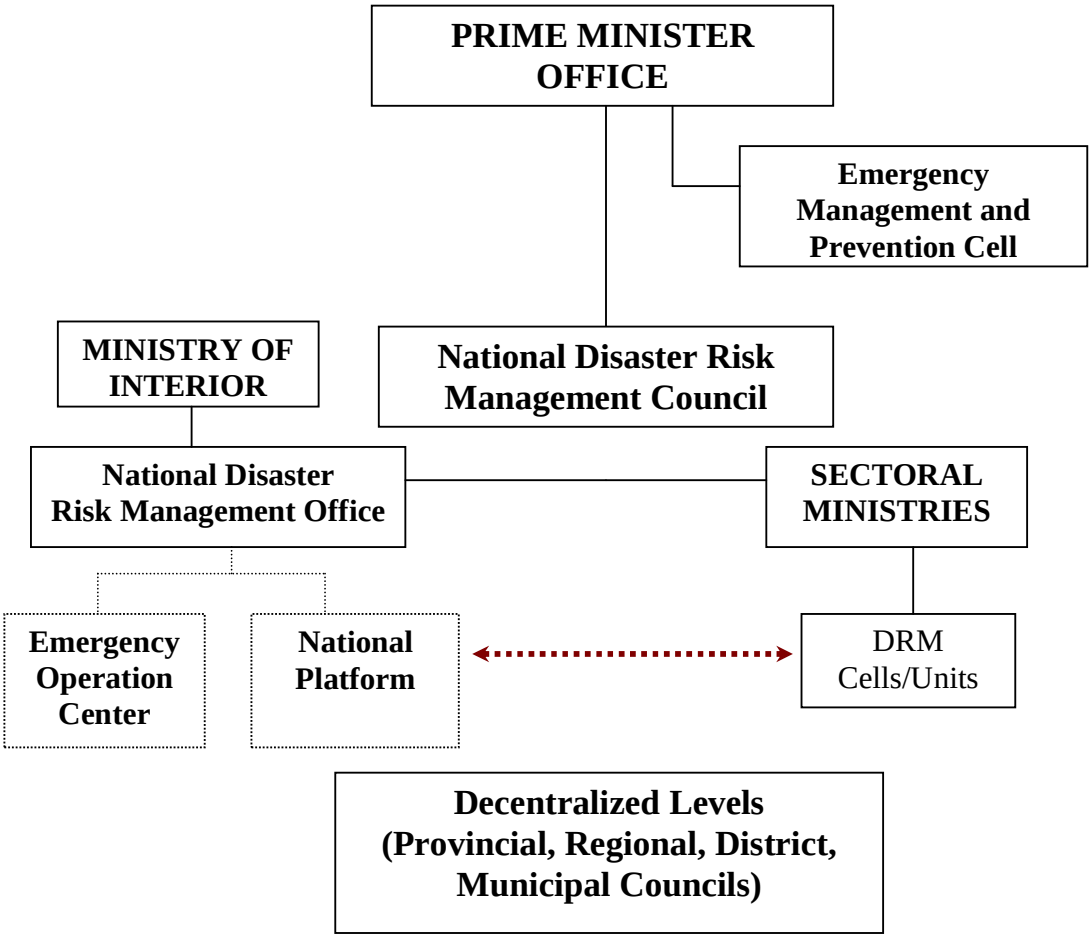
1 BACKGROUND

The elaboration process of the National Strategy on Disaster Risk Management in Madagascar was initiated in 2000.

The Strategy was adopted by law in 2003 (Law N0 2003-010).

In 2006 a new set of decrees is voted to facilitate the implementation of the strategy. New coordination and operational bodies are created.

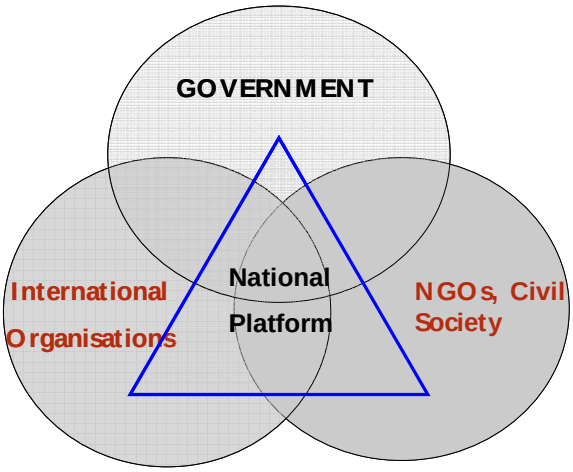
2 INSTITUTIONAL FRAMEWORK



3 HOW THE SYSTEM WORKS?

3.1 Coordination between stakeholders

The national platform gathers all stakeholders on Disaster Risk Management.

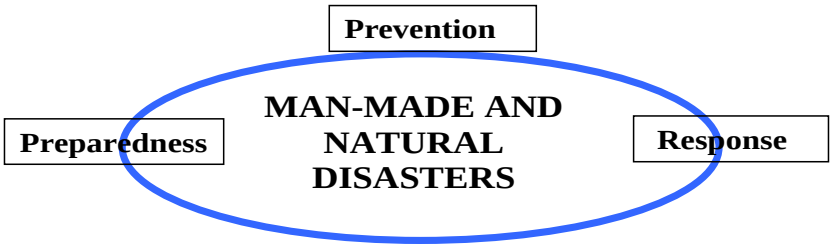


Structure of the national platform on Disaster Risk

The Meteorological Service is involved in the National platform on Disaster Risk Management by providing information (forecasts and monitoring) for decision making and planning before, during and after severe weather conditions.

3.2 Planning Disaster Risk Reduction activities

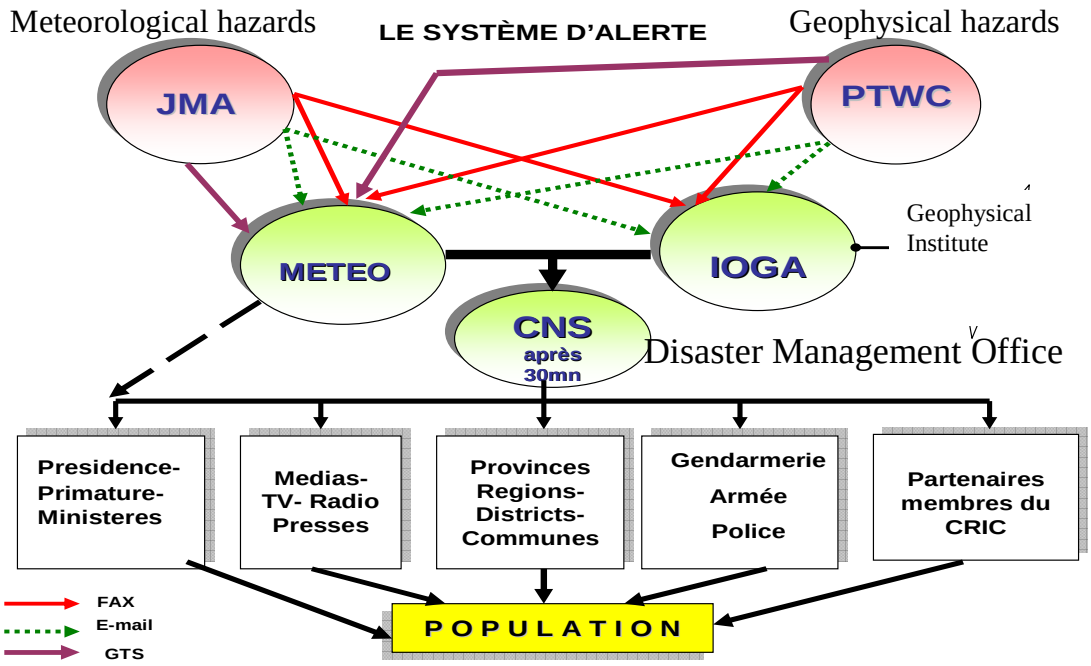
The National Disaster Risk Management Office is responsible for coordination of



The National weather Service contributes to all stages of disaster risk management.

Prevention: Training on how to reduce effects of severe weather condition (mitigation)
Preparedness: exercises, hazard awareness drills…
Response: facilitating and supporting civil protection assistance.

3.3 Warning system and dissemination process



4 LESSONS LEARNED

- The elaboration of the national strategy on Disaster Risk Management is a key for the reform process and gives an opportunity to improve coordination between the Direction Générale de la Météorologie and Disaster Management authorities (Bureau National de Gestion des Risques et Catastrophes- BNGRC).
- The Hyogo Framework of Actions has given more visibility for the Meteorological service at national level.
- Better severe weather forecasts have given a better credibility of the new DRR framework.

5 ISSUES TO BE IMPROVED

- Accuracy of forecasts in terms of spatial distribution of extreme events, their intensity and effects (use of Radar, NWP,…).
- The warning system is too cyclone oriented. Heavy rain, flood/flash flood, hailstorms and drought also affect Madagascar.

6 CHALLENGES AHEAD

- At national level, the need of accurate severe event forecast is stressed in the Madagascar Action Plan (MAP 2007-2011)

- Elaboration of Risk assessment and mapping regarding the forecast and warning messages

- Needs to better use the window of opportunity after disaster to mainstream the Disaster Risk Management

7 SUMMARY

In Madagascar, framework for an effective coordination in the field of Disaster Risk Reduction (DRR) has been build up.

But for more credibility, severe weather forecast should be improved (use of radar, NWP, downscaling at or national sub national level).

8 CONCLUSION

Complementary tools provided by the SWFDP should be the beginning of an efficient way to facilitate the implement DRR strategy in Madagascar by providing accurate and time sound forecasts.

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ANNEX VII.3

MOZAMBIQUE

COORDINATION BETWEEN MOZAMBIQUE METEOROLOGICAL SERVICES AND DISASTER MANAGEMENT AUTHORITIES

1 INTRODUCTION

The National Meteorological Services of Mozambique is supported by Government with the challenging task of providing a meteorological early warning service of potential hazardous weather to the country.

In Mozambique, almost natural disasters are weather related (climate and water).

Mozambique is vulnerable to natural disasters due to the geographical localization and widespread poverty. The vulnerability in the rural communities is high.

Since the 2000 flooding, the ability to cope with severe weather events is rising. The NMS uses now sophisticated systems like weather radars, numerical model and a high cooperation with the community broadcasting station.

2 THE MAJOR USERS OF METEOROLOGICAL SERVICES

Meteorological data have a vital role to enhance the development of the countries socio economics activities.

There fore the followings are some of the economic sectors, which are major users of meteorological information:

- Agriculture
- Transport
- Recreation and Tourism
- Electrical utilities and energy
- Media and general public
- Construction
- Environment and health
- Water resources
- Aviation
- Industry

3 METEOROLOGICAL ANALYSES AND FORECAST DEPARTMENT

This department is responsible for the organization and supervision of the various activities of weather forecast and early warning, aeronautical meteorology and meteorological communication teams.

Ensures the timely issuance of short-medium and long-range forecast and warning, on hazardous phenomena of the atmosphere, to concerned government authorities and to all users of all socio-economic sectors of the country.

4 GENERAL WEATHER HAZARD

When the disaster managers are early informed about a severe weather event, mobilisation of resources and particularly in cases where resettlement exercise or massive evacuation is necessary, the process is designed in advance (example during the Tropical Cyclone “FAVIO” and Zambezi flooding).

The effectiveness of those services demands great attention and coordination among NMS (Forecast and analysis department), the disaster managers, the water authorities and media.

However rich the meteorological warnings and alerts may be the way this message reaches the users still a high priority.

The media acts as transmitter of the warning and alerts and stands as a opportunity to the weather experts as well as hydrologist and disaster managers to give press conferences with common statements about the event.

The general weather hazard which leads the issuance of warning are:

- Strong winds
- Heavy rainfall
- Tropical cyclone
- Severe thunderstorm
- Heat waves (we rarely issue a warning)

5 RESEARCH AND DISSIMINATION ACTIVITIES

The NMS-Mozambique is actively involved in disaster management programs.

These programmes are organized by the national centre for emergency operations (CENOE), the head office is now in Caia, centre of Mozambique, where thousands of people were displaced till the end of the rain season there will stay a forecaster from NMS Mozambique to facilitate the coordination.

Through these dissemination activities, communities are educated on how to interpret the forecasts, warnings and the weather patterns that prevails at each season, by workshops given at the community, school and to journalists or community broadcasters.

The NMS coordinates and communicates the various tasks of conducting the agency’s meeting, seminars, workshop… etc; where initiates pure, applied research and investigational works on various aspects of Meteorology and allied disciplines. Presents the work of individual’s and or team of experts.

6 CONCLUSIONS

Although accurate forecast of severe weather events are issued, sometimes false alarm or severe weather event not predicted can occur.

Mozambique still requires an organized and trained group which can lead with severe weather events 24 hours a day and 7 days a week.

ANNEX VII.4

SOUTH AFRICA

COORDINATION BETWEEN THE SOUTH AFRICAN WEATHER SERVICE AND DISASTER MANAGEMENT AUTHORITIES

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1. OBJECTIVE

According to the World Meteorological Organization about 80% of natural disasters worldwide are weather related. This situation is similar for Southern Africa. These disasters include flooding, droughts, windstorms, severe storms and extreme temperature related disasters. Consequently national weather services contribute to all stages of disaster risk management, namely mitigation, preparedness, response and recovery. An integral role of SAWS in disaster risk management in South Africa is the provision of a meteorological early warning service of potential hazardous weather to the country.

Public acceptance and reaction to weather advisories and warnings is quite diverse and complicated in South Africa, due to its mixture of developing and developed areas. Most rural regions in South Africa are particularly vulnerable to natural disasters due to their limited coping and adaptive capacity as a result of widespread poverty, HIV/AIDS, population growth and the general vulnerability of rural subsistence communities. In many areas application of weather warnings to meet the needs of society is non-existent. On the other hand, in some well developed regions industries and communities benefit significantly through the use of early warning products. South Africa is fortunate enough to have a small but technically well developed weather service, that have established sophisticated systems like weather radars, numerical models, and proper data communication links.

Any application to enhance societal use of weather warnings must take these realities into account. The challenge lies in the application of sophisticated new technologies, developed in first world environments, to the benefit of communities at risk in developing environments allowing them to take efficient advantage of weather forecasts, reducing their vulnerabilities and increasing their coping capacities.

The enhancement of the early warning systems of hazardous weather as an end-to-end system is high on the agenda of SAWS. This implies that the technical abilities of its forecasters to identify hazards well in time and issue warnings to vulnerable communities must be enhanced. It also implies development of effective dissemination systems of forecasts and warnings to communities in a way that they understand and can react on.

2. INSTITUTIONAL CAPACITY FOR DISASTER RISK MANAGEMENT

2.1. SAWS mandate in terms of weather warnings

According to the South African Weather Service Act, No 8 of 2001, section 4(3) “Only the Weather Service may issue severe weather-related warnings over South Africa in order to ensure that there is a single authoritative voice in this regard”. According to Schedule 1 of the said act, paragraph 4 the SAWS is responsible for “The provision of weather and climatic forecasting and warning services intended for general benefit of the population and the safety of life and property”.

2.2. Institutional structure relevant to early warning and allocation of responsibilities

The weather forecasting activities of the SAWS are performed by its network of forecasting offices:

2.2.1. The National Forecasting Centre (NFC) in Pretoria is responsible for national guidance of potential hazardous weather of a general as well as maritime nature up to 7 days in advance. It also provides outlooks for potential hazardous conditions a week in advance and in partnership with the Innovation and Research Division seasonal outlooks for above normal or below normal rainfall patterns. It operates on a 24 hour, 7 days a week basis.

2.2.2. The Aviation Weather Centre (AWC) in Johannesburg is similarly responsible for aviation related warnings on a national scale. The AWC also operates on a 24 hour, 7 days a week basis.

2.2.3. Regional Forecasting Offices (RFO) at the major airports, namely Cape Town, Port Elizabeth, Durban and Bloemfontein are responsible for the detailed forecasts and warnings within their regions and along their coasts, and liaising with the Provincial and Municipal Disaster Management Centres in their regions. All the RFOs operate on a 7 days a week principle, but only from 4 am to 8 pm each day. The NFC and AWC stand in for severe weather activities during off-shift hours.

2.2.4. The Innovation and Research Division of the SAWS is responsible for research activities in support of the enhancement of the early warning system of the SAWS.

2.2.5. The Climate Information Service of the SAWS can provide all available historic weather information needed for disaster risk management purposes.

2.3. Observation systems

The SAWS has a number of relevant observation systems and products available in support of its early warning service. This include satellite information from the new MSG satellite from EUMETSAT, a network of ten weather radars, surface and upper air weather monitoring stations and a lightning detection network.

2.4. Forecasting information

Among the tools to interpret weather observations are software able to predict the tracks of severe storms over the next half hour from radar information. Numerical Weather Prediction models are able to provide guidance of weather patterns over the next two to seven days. Special combinations of various numerical weather prediction models (called ensembles) give guidance from two days up to fourteen days in advance on the likelihood of severe weather. Monthly and seasonal forecasts are done through sophisticated climate models.

2.5. National and international cooperation

The SAWS has excellent cooperation with international weather services and represents South Africa in the World Meteorological Organization. This cooperation allows the SAWS to have access to modern weather observation tools and forecasting models. As example the SAWS is running from September 2006 the latest UM Numerical Weather prediction model from the UK Met Office. The latest knowledge on the science of weather forecasting is readily shared between weather services and research institutions.

The SAWS is also designated by the World Meteorological Organization (WMO) as a Regional Specialised Meteorological Centre for Southern African region (labelled as RSMC-Pretoria). This implies that the SAWS supports the weather services of countries in this region through the supply of severe weather guidance products (as part of the WMO Severe Weather Forecast Demonstration Project) and other relevant information to these weather services.

3. THE EARLY WARNING SERVICE IN SUPPORT OF DISASTER RISK MANAGEMENT

3.1. General weather hazard classification

3.1.1. Temperature very low (Tx < 10°C and/or Tn < -10°C) Maximum expected temperature below 10° C and/or Minimum temperature below -10°C

3.1.2. Temperature very high (Tx > 40°C) Maximum expected temperature above 40°C

3.1.3. Discomfort index more than 38°C, Humiture >108

3.1.4. Sensible temperature (Wind chill) less than -15°C

3.1.5. Black Frost (The freezing of plant sap that results in a black appearance)

3.1.6. Heat wave: 3 consecutive days where the maximum temperature is expected to be more or equal to 5°C higher than the average maximum of the hottest month.

3.1.7. Gale force winds: more than 34 knots (approximately 68 kph)

3.1.8. Veld fire warning: Orange or red fire danger indices.

3.1.9. Heavy rain: 80% probability of precipitation greater or equal to 50 mm

3.1.10. Snow

3.1.11. Hail stones more than 14 mm in diameter

3.1.12. Tornados

3.1.13. Tropical cyclone(s) - In Mozambique Channel south of 20° S and/or within 300 km of South Africa.

3.1.14. Widespread sandstorms

3.2. Maritime classifications

3.2.1. Significant waves: higher than 5 m

3.2.2. Gale force wind: more than 34 knots (gale) or more than 46 knots (strong gale)

3.2.3. Tropical cyclone(s)

3.3. Aviation classifications

3.3.1. Thunderstorm(s), embedded

3.3.2. Severe line storms (squalls)

3.3.3. Severe hail

3.3.4. Severe turbulence and mountain waves

3.3.5. Tropical cyclone(s)

3.3.6. Ice accretion

3.3.7. Widespread sandstorm(s)

3.3.8. Volcanic ash

3.4. Monitoring and forecasting potential hazards

3.4.1. The general monitoring and hazard forecasting process is outlined in figure 1. SAWS has implemented a seamless forecasting system, where forecasts for all timescales from 3-month seasons, through month, week2, days 1-7 and nowcasting (0-6 hours) are issued with increasing details and accuracy.

3.4.2. Nowcasting (0-6 hours lead time): All forecasting offices continuously monitor the weather for the occurrence of severe weather hazards using the various observation systems and related tools.

3.4.3. Short to medium term forecasting (1-7 days lead time): Forecasters use the guidance of various numerical weather prediction models and ensemble products to predict the likelihood of hazardous weather for the coming days. Outlooks on potential developments for week 2 (8-14 days in advance) are also issued daily by the SAWS on its website.

3.4.4. Extended range and seasonal forecasting (Week 2, month and the next 3-month season): SAWS has established a monthly and seasonal forecasting system for the country giving outlooks on potential above normal or below normal rainfall and temperature patterns on the monthly and seasonal timescale. This information are updated on a weekly basis for the month forecast, and on a monthly basis for the 3-month season forecast. It is issued via the web and email to interested parties, including the National Disaster Management Centre.

3.5. Warning preparation and dissemination

3.5.1. The general warning process is also outlined in figure 1. If deemed necessary, an advisory will be disseminated for potential hazardous weather within the time frame 3-7 days, and a warning within the time frame 1-2 days in advance. In this way the advisories are a “heads up” for potential hazardous weather events, and a warning that the hazard is now real or even already occurring.

3.5.2. 3-7 days in advance: Both advisories and warnings are disseminated by SMS to disaster managers. Depending on the specifics of the advisory and warning, they will also be disseminated to the general public via the media on radio and TV stations or special media releases.

3.5.3. 1-2 days in advance: When a severe weather hazard is detected, the relevant forecasting office will send a warning by SMS to the relevant Disaster Management Centres, and where necessary have telephonic communications with the disaster managers. Warnings are also issued in the regular radio and TV broadcasts.

3.5.4. Nowcasting (0-6 hours): When a severe weather hazard is detected on the observation systems, detailed warnings are send by SMS to disaster managers, to keep them informed about the position,

strength and development of the hazard. Telephonic communications with disaster managers may also occur where needed. If needed these detailed warnings will be disseminated by radio to the public.

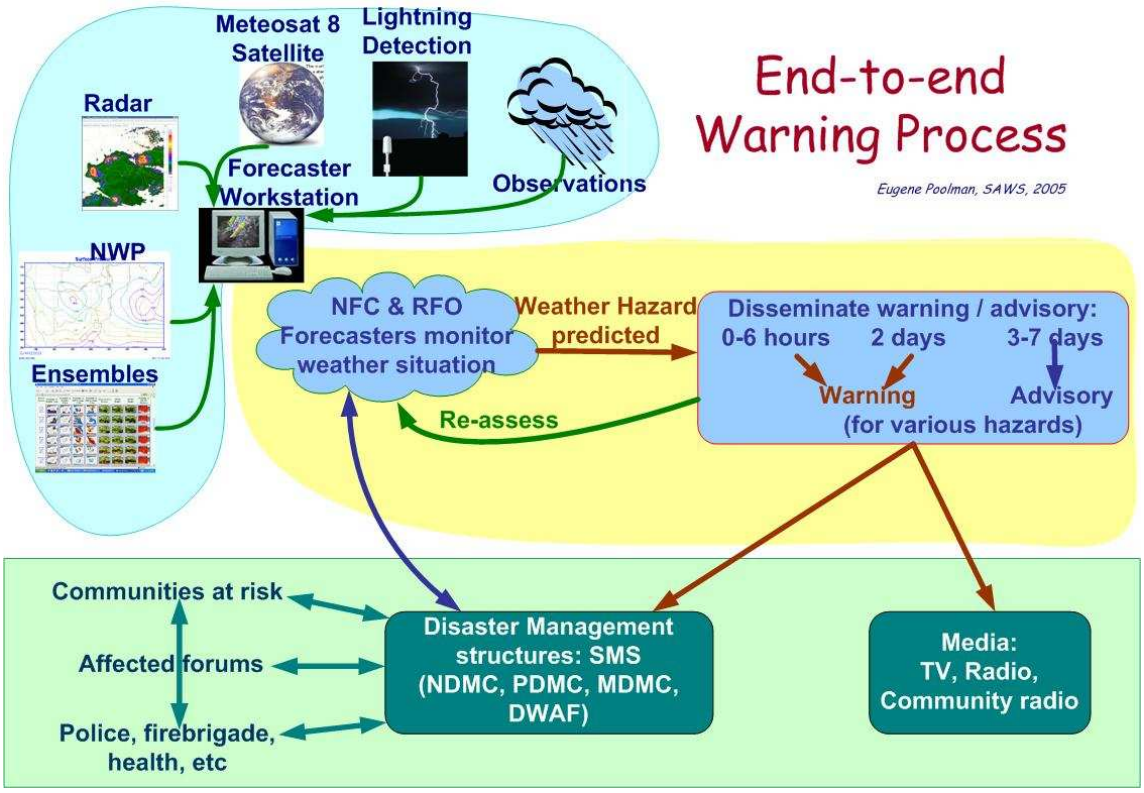


Figure 1: Early warning monitoring and dissemination process.

4. INFORMATION MANAGEMENT AND COMMUNICATION

4.1. Coordination between weather offices and Disaster Management Centres

4.1.1. National Forecasting Centre (NFC): The NFC is responsible for synchronisation of warnings with RFOs, as well as liaison with the National Disaster Management Centre (NDMC) and the flood forecasting room of the Department of Water Affairs and Forestry (DWAF). Regional Forecasting Offices (RFOs): Each of the RFOs is responsible for monitoring the weather and issuing detailed warnings for the provinces within its footprint. Warnings are issued for existing or expected severe weather conditions to the Provincial and Municipal Disaster Management Centres (PDMC and MDMC) within their responsibility regions as per mutual arrangement.

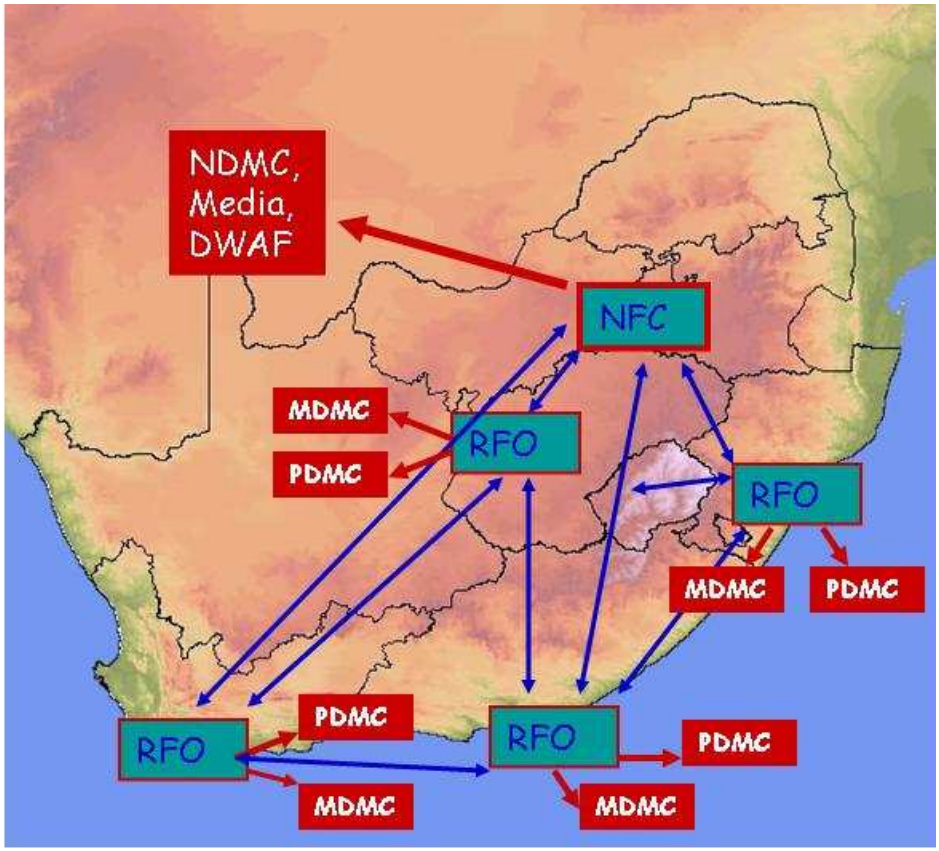
4.1.2. The coordination between the different weather forecasting offices is depicted in figure 2. Intensive coordination takes place between the relevant forecasting offices, particularly for cross-boundary hazards affecting more than one RFO's region of responsibility.

4.1.2.1. Although the NFC is responsible for issuing advisories for 3-7 days in advance, it will first seek consensus from the forecasters in the regional offices.

4.1.2.2. Similarly, no warnings are issued for days 1 and 2 without agreement between the relevant forecasting offices.

4.1.2.3. Detailed warnings for the next 6 hours are sent by the relevant forecasting office as soon as a hazard is detected, or a change is observed.

4.1.3. Officials from the different forecasting offices (NFC and RFOs) are members of the national or provincial disaster management forums or committees and attend various workshops on disaster management issues.



4.2. Public awareness raising

4.2.1. All forecasting offices are involved in raising the awareness of the public and communities regarding severe weather hazards that might affect them. This is done through visits of schools to the forecasting offices, participation in exhibitions and seminars or on request from community groups.

5. KNOWLEDGE MANAGEMENT AND DEVELOPMENT

5.1. Research and development activities

5.1.1. Research activities in the Research Division of SAWS focus on improving the services of SAWS. The two main areas relevant to disaster management dealt with are forecasting research, and observation research.

5.1.2. Forecasting Research: This group focus on three areas, namely the development and improvement of seasonal forecasting, secondly the improvement of the numerical weather prediction model for South Africa, and thirdly improving short-range forecasting and warnings through development of guidance products and methodology from the models and observation platforms for forecasters, and studies on the improvement of the early warning system.

5.1.3. Observation Research: This group concentrate on the enhancement of the products from remote sensing platforms (satellite, radar and lightning) to improve nowcasting of severe weather.

5.2. New technologies to improve warning system

5.2.1. The SAWS is implementing a recapitalization plan to enhance its observation equipment, forecasting software and numerical models. The early warning service will directly benefit from this upgrade. The upgrade includes:

5.2.1.1. Additional weather radars to improve radar coverage for severe storm detection and rainfall estimation,

5.2.1.2. A lightning detection system (already installed),

5.2.1.3. The new numerical weather prediction model (Unified Model from the UK Met Office) to enhance the guidance to forecasters for the next 2 days,

5.2.1.4. New forecaster display software (Ninjo developed by the weather services of Germany, Denmark, Switzerland and Canada) to allow better decision making by the forecasters.

5.2.2. SAWS is developing a collaboration with the US National Weather Service to acquire a sophisticated flash flood guidance system that will allow more informed decision making regarding the issuing of flash flood warnings for South Africa and eventually Southern Africa. This system will be installed in 2007 as soon as financial arrangements are finalized.

5.3. Forecaster training

5.3.1. The SAWS collaborates for many years with the University of Pretoria to train weather forecasters to international standards. Partnerships are established with training institutes of other renowned international weather services to maintain highest standards.

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ANNEX VII.5

TANZANIA

REPORT FROM TANZANIA DISASTER MANAGEMENT DEPARTMENT IN THE PRIME MINISTERs OFFICE

1 INTRODUCTION

The Disaster Management is the government institution which operates under the Prime Minister's Offices.

Legal Mandate of the main Disaster Management institution is to have a safe livelihood with minimum of disaster interruptions to social and economic development issues.

The department thrust is to develop adequate capacity for coordination and cooperation for comprehensive disaster management among key players at all levels by mainstreaming. DM activities are integral part of development programs of all sectors in the country.

The Act no 9 of 1990 regulates the Disaster Management activities.
Functions of DMD according to the act are

- Coordinate all disaster relief operations and preparedness measures
- Carry out or coordinate all research relevant to its functions for the purpose of advising the committee on measures necessary for disaster prevention.
- Arrange for and carryout on behalf of the committee, the dissemination of the information concerning disaster operations, preparedness and prevention
- Review regularly and coordinate the different disaster prevention measures.

2 STRUCTURE OF THE DISASTER MANAGEMENT

The Disaster management structure in Tanzania has institutions established vertically and horizontally. The structure has National level committees as well as village which is the lowest level.

3 IMPORTANCE OF METEOROLOGICAL INFORMATION TO THE COMMUNITY IN TANZANIA

Tanzania economic development has been adversely affected by weather and climate related disasters (drought, floods, tropical cyclones, landslides, and Tsunami).

Societies are increasingly affected by inter annual variations in climate such as those associated with El Nino/La Nina, which affect precipitation and temperature on inter-annual timescale that are only predictable to some degree.

These regional climatic shifts produce weather related hazardss associated with climate variability. The prevalence of drought and floods that trigger disasters show that many Tanzanian societies are vulnerable to natural climate variability and extremes.

These factors are expected to influence the occurrence and impact of disasters by affecting the intensity and frequency of extreme events. In recent years parts of Tanzania have experienced recurring droughts. The most devastating were those of 1983 - 1984 and 1993 – 1994.

According to Tanzania historical data, we have droughts every four years which affects 3629239 people. The most frequent hit areas are, central areas of Dodoma, Singida and some parts of Pwani, Shinyanga, Mwanza and Mara. These regions receive 200 –600mm of annual rainfall. Experience of the past twenty years 1980-2000 has shown that floods occurred 15 times and killing 54 people and affecting 800271 people. Flood prone regions are Tanga, Mbeya, Pwani, Morogoro, Arusha, Rukwa, Iringa, Kigoma and Lindi.

In the area of drought/floods prevention and mitigation, there are number of coordinated and collaborative initiatives that are foreseen and they are undertaken within a frame work of the Ministry of Agriculture, Food and Cooperatives involving all its working group which include Meteorological . Agency.

Drought is characterized in terms of its spatial extension, intensity and duration. Its creeping characteristics and various impact make the adoption a precise and universally definition of drought difficult.

Tanzania currently has access to real time satellite meteorological information from Tanzania Meteorological Agency.

Integrated disaster management and management systems require complicated communication hardware, data acquisition and processing equipment, and powerful computers to integrate and analyze the information for decision making.

This type of disaster mitigation system is not currently integrated in Tanzania, thus each type of disaster is managed by a separate command centre but does share information with other centre.

Therefore the Disaster Management Department mandate includes integration of these systems into one command centre which utilizes information from all disasters for formulating preparedness and response strategies.

In Tanzania, as elsewhere, meteorological applications are for the benefit of mankind and the attainment of national sustainable development goals.

During the past 20 years, considerable progress has been made by Tanzania Meteorological and Hydrological Services at local levels, in the provision and coordination of weather-related activities and in assisting the different local centres in improving weather services to the general public and advising them how best they can be used.

In a time of increasing awareness particularly Tropical cyclone formed in Indian Ocean (BONDO) in December 2007, the need for meteorological information and interaction with user groups was essential to succeed in providing the various services for national disasters prevention and development planning. The Meteorological Agency provided the required information about the cyclone on time.

It is therefore of the greatest importance that meteorological information should be available and that the National Meteorological Centers understand what the user groups need for national planning purposes and ensure that the public understands what service it may expect and how it may use that service.

CHALLENGES

Lack of financial resources is required to establish an integrated disaster management system such a weather radar to monitor the impact of tropical cyclones from the Indian Ocean and also to monitor microscale systems which may cause disasters..

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ANNEX VII.6

ZIMBABWE

COORDINATION BETWEEN ZIMBABWE METEOROLOGICAL SERVICES AND DISASTER MANAGEMENT AUTHORITIES

1. INTRODUCTION

The Department of Civil Protection of Zimbabwe is tasked by Government with the responsibility to ensure optimal emergency preparedness and disaster prevention at the individual, community, sectoral, local authority and national level through regulatory mechanisms and coordinated strategic planning for emergencies.

In Zimbabwe, more than 70% of all natural disasters are related to weather, climate and water. Thus, severe weather events are a major cause for concern to civil protection.

The Department of Civil Protection was informed of the SWFDP – RA1 Southeast Africa before its commencement last year and have been following its progress with special interest. This demonstrates a cordial relationship between the Meteorological Services Department and the Department of Civil Protection which has become formidable over the years.

2. REQUIREMENTS OF DISASTER MANAGEMENT IN RELATION TO SEVERE WEATHER

Zimbabwe's Department of Civil Protection fundamentally requires 4 types of information about a severe weather event from the meteorological service. These relate to the specific details of the event including:-

- severity of the event
- spatial coverage/specific areas affected
- projected onset and duration of the event, and
- concise description of the threat posed by the hazard

It is important for the meteorological service to target its products and services at those questions that matter most to users of meteorological information. It is even more important to package the information in the most usable ways.

The most critical requirement is early notification of civil protection authorities ahead of the severe weather event to allow for proactive disaster management. Adequate lead time is necessary for mobilisation of resources and especially in cases where resettlement is necessary. Resettlement is mostly done in cases when tropical cyclones are affecting the country. A typical example is the massive evacuation and resettlement exercise undertaken with the assistance of the Air Force of Zimbabwe in February 2000 when the country was overwhelmed by

heavy precipitation and strong destructive winds associated with Tropical Cyclone Eline. The timing of meteorological warnings and alerts was impeccable.

Civil protection authorities also require additional information from the hydrological service as they have the expertise with regards the hydrology of the country including the state of rivers and dams. The water authorities also assist disaster management by providing guidance on the most vulnerable areas to flooding. Often, heavy precipitation events in the eastern highlands of Zimbabwe also cause flood events in areas far removed from the severe event. This underscores the importance of strong interaction between the Meteorological Services Department, the Zimbabwe National Water Authority and the Department of Civil Protection before, during and after the severe weather event. Interactions among neighbouring National Meteorological Centers of the region are also vital since severe weather events do not observe political boundaries.

3. METHODS OF EFFECTIVE DISSEMINATION – THE ROLE OF THE MEDIA

After informing policy makers in Government of an imminent severe weather event, the meteorological service often convenes a discussion comprising the weather experts as well as hydrologists and civil protection authorities. A common statement is then drafted for immediate dissemination to the public and other relevant stakeholders.

The media plays a pivotal role in the dissemination of severe weather information. Whilst newspapers and television are effective means of communication to the urban communities, the radio is especially important for those poor and marginal rural communities which are often the most vulnerable.

One major drawback in the dissemination of alerts, advisories or warnings by either the Meteorological Services Department or the Department of Civil Protection is exaggeration by some sections of the media with the result of causing panic. Often, an alert for

"Localised heavy falls of rain with significant chances for flash flooding especially in low altitude areas"

will get a sensational headline in the local daily *"**Flood Warning**".* Such a headline will obviously increase sales of the newspaper, but may seriously cause harm and unnecessary panic among communities. Such journalism also damages the image of the meteorological service with regards credibility of the institution on severe weather forecasting. A plan is there to meet with media people and appraise them of the potential damage which can result from irresponsible journalism.

4. OUTREACH PROGRAMMES

The Meteorological Services Department of Zimbabwe is actively involved in disaster management outreach programmes countrywide. These programmes are mostly organised by the Department of Civil Protection before, during and after the rainfall season every year. The overall goal of such outreach programmes is to raise awareness on the flood hazard in order to reduce vulnerability of communities in flood prone areas and the specific objectives were as follows:-

- To educate rural communities to interpret meteorological information and therefore make informed decisions based on that.
- To increase knowledge on flood risk
- To improve early warning systems
- To identify safe havens in case of flooding
- To improve knowledge on health risks associated with flooding
- To improve knowledge on rescue efforts that can be employed by communities

Through these outreach programmes, communities are educated on how to interpret probabilistic forecasts and to also monitor precipitation upstream of their villages as heavy rainfall events upstream can cause serious rises in river flows and/or flooding downstream.

These outreach programmes are very effective but they don't reach all intended targets. This results mainly from limited resources such as vehicles, subsistence allowances and also human resources to conduct this exercise.

5. THE USEFULLNESS OF PRODUCTS ISSUED BY ZIMBABWE METEOROLOGICAL SERVICES

On the whole, whilst the Meteorological Services Department of Zimbabwe has a good contemporary record of severe weather forecasting, there has been a marked improvement in severe weather information and products provided by the Service since the commencement of the SWFDP in November 2006. This improvement is noted by Civil Protection authorities in terms of

- the timeliness of sever weather information
- the relevance of the severe weather information for disaster management
- the salience of the information
- the credibility of the information, and
- the interaction between the Meteorological Services Department
- and the Department of Civil Protection

However, there is still need for more detail and specifics with regards which actual locations would be hit by severe weather. It is difficult to mobilise resources for a whole province when the event may only occur, for example, in a small district. This has been attributed to the rather coarse horizontal resolution of the forecast guidance products provided by the global centers.

It cannot be overstated that disaster management operations are very costly and often unbudgeted for such that its critical for the Meteorological Department of Zimbabwe to provide accurate forecasts of severe weather events as false alarms can result in significant losses of Government resources in addition to causing unnecessary panic and confusion.

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