SEVERE WEATHER FORECASTING DEMONSTRATION PROJECT (SWFDP) – RA1 SOUTHEAST AFRICA

FINAL REPORT OF ZIMBABWE TO SWFDP (NOVEMBER 2006 TO NOVEMBER 2007)

INTRODUCTION:

The Severe Weather Forecasting Demonstration Project (SWFDP) of the World Meteorological Organization was implemented first in RA1 (Southeast Africa) during the period from November 2006 to November 2007. Five National Meteorological Centers (NMCs) of Botswana, Madagascar, Mozambique, Tanzania and Zimbabwe participated in the Project. Some Global Centers (UK Met Office, ECMWF, NCEP) and Regional Specialized Meteorological Centers at Pretoria and La Reunion provided NWP products and forecast guidance consistently throughout the duration of the project. The demonstration project for RA1 is now ended and Zimbabwe is pleased to report a record of positive success having achieved the objectives of the Demo Project resoundingly.

The project was conceived in order to achieve the following:

- To demonstrate how cooperative work among meteorological centres can be further exploited in order to enhance the forecasting process of several types of severe weather and to improve warning services at the NMHSs;
- To make better use of existing NWP models and products including those derived from Ensemble Prediction Systems and train forecasters of NHMSs that have not yet used or applied them and to demonstrate their utility in decision-making;
- To improve the ability of NMCs to forecast severe weather events;
- To improve the lead-time of alerting of these events;
- To improve interactions of NMCs with Disaster Management and Civil Protection Authorities before and during events;
- To identify gaps and areas for improvements;
- To improve the skill of products from GDPFS centres through feedback from NMCs.

The implementation of the project suffered setbacks at first. For example, many of the products were new to Forecasters. Ensemble Prediction Systems, including EPSgrams were misunderstood and therefore misused at first. As expected, some Forecasters, especially the more experienced Forecasters resisted change, being comfortable with what they have worked with for many years. The accessibility of products was also difficult at first but was improved with time. With time, all these challenges were overcome.

The guidance products available through the SWFDP are 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.

Whilst the greater part of the project year in Zimbabwe was generally quiet in terms of severe weather events, the regional and global guidance products available on the SWFDP proved very useful for weather forecasting in general. Specialized forecasts for aviation as well as agrometeorological services also benefited from the project.

This report summarizes the participation of Zimbabwe in the SWFDP in terms of severe weather forecasting, usefulness of products and guidance available and the contribution of the NMS toward natural disaster reduction.

SUMMARY OF SEVERE WEATHER EVENTS FOR THE PERIOD:

PERIOD: 6 November 2006 – 28 February 2007:

The first quarter of the SWFDP was characterized by the highest number of severe weather events (more than 30) mainly in the form of heavy precipitation. The period December to February is historically the wettest period of the year. It is also the period when the Inter-Tropical Convergence Zone is active over the subcontinent and tropical cyclone activity in the southwest Indian Ocean is at its peak.

The most significant event of the first quarter was that associated with Tropical Cyclone Favio which affected the country about the 22nd February 2007. Interestingly, it was nearly exactly the same time that Tropical Cyclone Eline affected Zimbabwe in 2000. Although cyclone Favio had been forecast to dump heavy rains across much of northern Zimbabwe, it weakened considerably upon entering Mozambique. However, there were still high amounts of rainfall received in the eastern border highlands of Zimbabwe and associated damage to property. The cyclone track was very well predicted by Ensemble Prediction Systems and with such high confidence, the weather alerts and warnings were very relevant and accurate and well received by users.

PERIOD: 1 March 2007 – 31 May 2007:

Historically, rainfall is by far the most important climate factor over the country and is highly seasonal, mostly received during the austral summer from about early October through to early April. Hence the period of the second quarter was characterized by a significant decrease in rainfall activity over the country and ultimately the cessation of the main rainfall season. Thus, whilst rainfall activity continued up to about mid-April 2007, there were only 4 severe weather events in Zimbabwe during this quarter.

Despite the absence of significant weather, the regional and global guidance products available on the SWFDP were very useful.

PERIOD: 1 June 2007 – 31 August 2007:

The period of the third quarter (June – August) is typically the driest of the year in Zimbabwe. There is little moisture in the air, and above 3 kilometers where there is a persistent temperature inversion, the air is extremely dry. The normal regime is therefore one of fair, mild days with little or no cloud. Thus, it is not unusual that according to SWFDP criteria, there were no severe weather events during this period. However, there was a short lived winter wet spell which occurred on 2 June 2007. Widespread rain showers and thunderstorms affected the country although rainfall amounts recorded were below 50 mm. The event was detailed as a case study in the second quarterly report of Zimbabwe to the SWFDP.

Climatologically, the third quarter is also the coldest period of the year in Zimbabwe. Thus, the only significant weather events that occurred were associated with very cold spells which resulted in severe morning ground frosts affecting a significant area of the winter crop. The SWFDP global and regional products and guidance added significant skill to frost forecasting in Zimbabwe.

PERIOD: 1 September – 30 November 2007:

The first rains of the rainfall season usually occur during this quarter. The early rains come in October whilst the mean onset of the main rains is about mid-November. In 2007, there was a delayed start to the rainfall season. The few rainy days of November did not constitute severe weather events as the precipitation was generally light. The weather was predominantly dry and hot across the country for the most part of the 4th quarter. When the rains eventually came in early December, there were several severe weather events with a number of flood events and associated damage. December 2007 was recorded as the wettest December since records began in Zimbabwe with some areas accumulating more rainfall than their seasonal average in only one month. Whilst these severe weather events of December 2007 are outside the duration of the Demonstration Project, they make a spectacular case study, and are detailed in an attachment to this report.

PRODUCT EVALUATION:

a) Usefulness of RSMC-Pretoria guidance

The South African Weather Service (SAWS) Regional Specialised Meteorological Center (RSMC) severe weather guidance provided a good starting point to a Forecaster coming in for duty. The short and medium range maps, risk tables and discussions of RSMC Pretoria are particularly used as a quick guide to severe

weather over the subregion. The graphic presentations (maps, risk tables and discussions) proved to be very effective especially when presenting impending severe weather to lay people.

The RSMC website was the best. Nearly everything was available through their page and the products and guidance were consistently up-to-date throughout the duration of the SWFDP. Even today, the dedication of RSMC Pretoria Forecasters to providing guidance to NMCs in southern Africa is highly regarded.

b) Usefulness of SWFDP NWP/EPS Products received from each global centre and RSMC UM-SA12

Some products were used more than others and it emerged that ECMWF products were the most used and most trusted by Forecasters in Zimbabwe.

Most global models had difficulty resolving tropical convective precipitation of a localized nature. NCEP precipitation models faced the greatest difficulty in this regard. However, Forecasters are aware of this limitation and are able to give good forecasts still. RSMC Pretoria Forecasters also seem to have difficulty with tropical convection in their guidance to participating Centers.

EPS-grams from ECMWF and UK Met Office are arguably the best tool made available through the SWFDP. They skill is very high especially in determining the onset, evolution and decay of events. They were also useful in forecasting the intensity of events, especially rainfall and wind. A major strength of EPSgrams is the lack of 'jumpiness' which is sometimes exhibited by other models which is why they are dependable.

The UK Met Office Africa LAM was very useful for the most part. Even the 12 km Unified Model run by RSMC Pretoria provided very fine detail and guidance on areas to be affected by heavy rainfall. Of course, because of the high resolution, it was not possible to get forecasts of several days ahead.

Satellite Data and derived imagery (RGB) proved to be an invaluable tool especially in the evolution or decay of convective activity. Shorter time interval between successive pictures meant data was almost real time.

RESPONSE FROM DISASTER MANAGEMENT AUTHORITIES

More than 80% of natural disasters in Zimbabwe are related to weather, climate and water. Therefore, the Disaster Management and Civil Protection Authorities (DMCPAs) often have to deal with disasters related to different types of severe weather or climate.

At the beginning of the project, NMS Zimbabwe held meetings with key stake holders such as the DMCPAs, Zimbabwe National Water Authority and the Media and apprised them of the scope of the SWFDP. In turn, DMCPAs indicated that they require certain details about weather related disasters. Details about the event should include the following:

- 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 the view of the NMS that DMCPAs actively participated in the SWFDP throughout its duration including presentations at the SWFDP Management Team review meeting held in Maputo in February 2007. In several cases of severe weather, DMCPAs and Hydrologists were invited to weather chart discussions to discuss the forecast and possible implications. These discussions resulted in formulation of joint statements of warning of impending severe weather (see Appendix 1). This demonstrates a very strong working relationship between the NMS and DMCPAs which is one of the main goals of the SWFDP.

Recently, following the launch of the SWFDP, Forecasters have become more involved in field visits to monitor and assess the extent of flooding and associated impact during and after a flood event. These assessment teams are multi-sectoral, comprising Government, UN agencies in Zimbabwe, Non-governmental Organizations and Local Authorities in affected communities.

SUMMARY:

By far the greatest impact of SWFDP is increased accuracy of weather forecasts! As a result, the ability of Forecasters from NMS Zimbabwe to predict severe weather events is now beyond reproach. There is high confidence in weather forecasts as rated by the people of Zimbabwe and a vastly improved lead-time of alerting of significant weather events to the people, Government, DMCPAs and the Media.

Zimbabwe continues to receive positive feedback from various stakeholders with regards accuracy, timeliness and relevance of weather forecasts and warnings.

The unavailability or sparse nature of surface and upper air observations from the region is serious cause for concern. Observations are nearly always incomplete and data transmission is often delayed by communication breakdown and power outages. Surface, upper-air, satellite and radar observations form the basis of any forecast process. Incompleteness of observations or delays in transmission have significant impact on the timeliness and accuracy of severe weather forecasts.

Whilst Internet connection in the NMS remains fairly slow, accessibility of model guidance from the various websites has improved markedly. Forecasters can now download products and guidance in a reasonable space of time. This may be attributed to experience of Forecasters navigating around websites. Of course, efforts are still in place to upgrade the connection to broadband or satellite connection.

Having had "hands on" experience with the SWFDP, the need for continued access to products and guidance availed to NMSs cannot be overstated. The output of NMS Zimbabwe would retrogress if that were to happen. Appreciation is therefore due to the World Meteorological Organization, the UK Met Office, ECMWF, NOAA NCEP, RSMC Pretoria and RSMC La Reunion. Zimbabwe was particularly privileged to have 3 Forecasters trained in Pretoria whilst a fourth Forecaster was seconded to the African Center for Meteorological Applications for Development (ACMAD) in Niger on the same project.

In view of the impact of severe frosts on winter agriculture and livelihoods, it is recommended that WMO consider extending the criteria for severe weather to other extreme meteorological phenomena for subsequent demonstration projects in other regions. These include hard frosts, extreme heat, dust storms and exceptional fire hazard depending on the vulnerability of that region.

It is also recommended that, in the case that the Meteorological Service is separate from the Hydrological Service, that the WMO consider involving the National Hydrological Service in addition to the DMCPAs in future demonstration projects.

Please refer to Appendix 1 for media extracts whilst a case study for severe weather events that occurred in December 2007 is provided separately.

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