SWWS and Severe Weather Forecasting Demonstration Project - Southern Africa (SWFDP-SA) as part of DRR

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SAWS
Overview of Discussion

1. SWWS as part of Multi-Hazard Early Warning System (MHEWS)
2. Severe Weather Hazards in Context
3. The Severe Weather Warning System (SWWS)
4. Technological Support Systems for SWWS
5. Impact Based Forecasting
6. SWFDP
Impact of Disasters on South Africa: 1920-2008 (Source: CRED)

- 95% of Natural Disasters in Southern Africa are weather related
- Most important disasters for South Africa is drought, floods, wild fires, windstorms
- Internationally, flooding kills annually on average 7,500 people, of whom about 5,000 are from flash floods
- In SA between 1980 and 2009 on average 35 people die annually due to large flooding disasters (declared disasters)
SWWS as an End-to-End Warning System

South African Weather Service

SAWS Web-page

Media

Disaster Management Centres
- National
- Provincial
- Municipal

Communities at Risk
Increasing Urgency through Alert Levels

<table>
<thead>
<tr>
<th><strong>No Alert</strong></th>
<th><strong>Advisory</strong></th>
<th><strong>Watch</strong></th>
<th><strong>Warning</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>No hazardous weather expected in next few days</td>
<td>Be Aware!</td>
<td>Be Prepared!</td>
<td>Take Action!</td>
</tr>
</tbody>
</table>

- Early warning of potential hazardous weather
- Weather conditions are likely to deteriorate to hazardous levels
- Hazard is already occurring somewhere or is about to occur with a very high confidence

- 2 to 6 days period
- 1 to 3 day period
- Next 24 hours, 3 hrs for FF, TS
Modern Technology in Support of EWS

- Seasonal forecasting 1-3 months: Global Climate Models provide *Outlooks*
- Forecasting 1-7 days: NWP provide scientific information on the likely *Advisories, Watches and Warnings* to be issued
- Nowcasting 1-6 hours: Radar and satellite tools to identify and locate severe weather phenomena and the predicted areas under threat in next few hours
- New systems modernize the EWS for *flash flood* warnings, *storm surge* warnings, *veld fire* warnings
Impact Based Forecasting

- South African Weather Service is collaborating with NDMC to move towards Impact based Forecasting.
- 3 year project
- The project, including implementation will run April 2015 to March 2018
- Collaboration with UKMET through Newton Fund programme to effectively tap from the knowledge and lessons learned from their implementation of Impact based forecasting
Proposed system operation

Based on the example of best practice at the UK Met Office, severe weather warnings are issued as a joint effort between forecasters and disaster managers (please refer to the Figure 1 below).

![Risk Matrix](image)

**Figure 1: Risk matrix**

*Source: WMO (2014)*
Likelihood of hazard:

• Similar to the current practice in SAWS, the forecasters issue an indication of the likelihood of a severe weather hazard (very low likelihood, low, medium or high)
• based on numerical weather prediction models, radar, satellite, flash flood guidance, etc.
• This allows for an indication of the uncertainty level of the expected hazard.
• Most warnings for hazards a few days away will probably be assigned a lower likelihood.
Level of impact associated with hazard

• Disaster managers provide input on the appropriate level of impact (very low, low, medium or high)
• depends on the vulnerability in the particular geographic area
• based on impact tables developed earlier with disaster managers at PDMC and MDMC level for each hazard for each area (district municipality or local municipality size).
• Time permitting, real-time assessment from relevant disaster managers should be acquired before a final decision is made.
WMO SWFDP Program

Aim

• To improve ability of National Meteorological Services (NMSs) in developing regions to forecast severe weather events for the next 5 days using existing technology – to close the technology gap

• To improve interaction of NMSs with Disaster Management Agencies

• SWFDP is about *enhancing delivery of warning services as adaptation against a likely increase of disasters due to climate change and socio-economic vulnerabilities*
SWFDP Concept of Cascading of Information

Global Centers

Regional centre

Global NWP centres

RSMC Pretoria

16 National Meteorological Centres

Disaster Management Centres
Examples of SWFDP Guidance Products from RSMC Pretoria

Risk and Probability Tables

Risk Tables:  DAY 1: Sunday 7th January 2007

<table>
<thead>
<tr>
<th>RISK</th>
<th>HEAVY PRECIPITATION</th>
<th>STRONG WINDS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No risk</td>
<td>Low risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Botswana</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Madagascar</td>
<td>W</td>
<td>C-est W</td>
</tr>
<tr>
<td>Mozambique</td>
<td>NE</td>
<td>X</td>
</tr>
<tr>
<td>Tanzania</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Probability Tables:  DAY 3: 09th January 2007

<table>
<thead>
<tr>
<th>HEAVY PRECIPITATION (exceeds threshold 50 mm/hrs)</th>
<th>STRONG WINDS (exceeds threshold 2015s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability</td>
<td></td>
</tr>
<tr>
<td>&lt;10%</td>
<td>&lt;10%</td>
</tr>
<tr>
<td>30%</td>
<td>30%</td>
</tr>
<tr>
<td>60%</td>
<td>60%</td>
</tr>
<tr>
<td>&gt;80%</td>
<td>&gt;80%</td>
</tr>
<tr>
<td>Botswana</td>
<td>X</td>
</tr>
<tr>
<td>Madagascar</td>
<td>NW</td>
</tr>
<tr>
<td>Mozambique</td>
<td>X</td>
</tr>
<tr>
<td>Tanzania</td>
<td>X</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>X</td>
</tr>
</tbody>
</table>

FCAST-PRE-20160420.1
Warnings from National Meteorological Services

- NMSs evaluate model products supported by RSMC guidance products
- Issue warnings if needed against their own in-country criteria for severe weather
- Provide disaster management with up to 5 days lead-time of expected major hazards
- Coordinate with media for end-user dissemination
Evolution of the SWFDP-SA Project

• Phase 1: July 2006 – Oct 2006
  – started with a planning meeting in Aug 2006 in Pretoria, South Africa, followed by the first regional training session in November 2006 in Pretoria, South Africa

• Phase 2: Nov 2006 – Nov 2007
  – The demonstration phase based on 5 NMCs, RSMC, 3 Global Centres

• Phase 3: Dec 2007 – Dec 2011
  – MASA requested WMO to roll SWFDP out to the entire region, based on the successes of the demonstration phase
  – The SWFDP activities was rolled out to all 16 Southern African countries
Evolution of the SWFDP-SA Project: Phase 4

- Phase 4: Jan 2012 - ?
  - Long-term sustainability and continuous development phase
  - SWFDP-SA oversight has been transferred from WMO to MASA
  - Embracing other warning system into the basic framework established by SWFDP – flash flooding through SARFFG, etc.

- Recognized that some countries need more help to fully benefit from SWFDP = specific efforts will continue to support those countries

- SWFDP developed a framework for collaboration among NMSs, and with their disaster management structures and media to be used by other programmes
Example: Tropical Cyclone Favio
20-24 Feb 2007

- TC Favio caused widespread damage over Mozambique and Zimbabwe
- The consistency of model forecasts provided confidence to RSMC Pretoria to issue guidance to NMCs on potential landfall and movement 5 days in advance
- The model forecast proved to be quite accurate with landfall at Vilancoulos, moving to Eastern Zimbabwe
Impact of Tropical Cyclone Favio

- In both Mozambique and Zimbabwe the NMCs agreed with the guidance products and issued warnings up to 5 days in advance to disaster management departments.
- Both countries responded early:
  - Provinces were put on alert levels 2 - 3 days in advance.
  - The public responded well and major loss of live were prevented.
Example: Tropical Cyclone IRINA- 4 March 2012

- On 1 March it was projected to hit southern Mozambique, NE parts of South Africa and Swaziland.
- These were the areas which were hit by “Dando” less than 2 months before with severe flooding.
- Highly unpredictable even by NWP, resulted in exemplar forecast coordination between the 3 countries.
- 4 fishermen died at sea off Maputo, and 3 people in southern Mozambique, widespread damage.
Irina continued.....

- The initial communication was by email from RSMC Pretoria on 01\textsuperscript{st} March 2012 to both INAM and SWAZIMET
- Follow-up discussions followed over next few days between the 2 NMS’s and RSMC Pretoria via emails and a number of telephone calls
- Disaster management authorities in all 3 countries were alerted by their NMSs
- Regular updates to Disaster Management and Media during Irina was crucial as the forecast track kept changing at short notice
- Excellent example of the successful functioning of regional early warning communication chain established through SWFDP
Capacity Building Activities

• Training:
  – Two-week training takes place annually during Nov for 16 countries in Southern Africa
  – Some country visits to where a specific need occurred

• RSMC Training Desk pilot project (October)
  – 2 forecasters from 2 countries for 2-weeks at RSMC Pretoria forecasting desk
Successes and Challenges of SWFDP

• SWFDP was generally successful in building the forecasting capacity and improving warnings services in many countries, because:
  ✓ Of its simplicity and operational focus (NMSs only needed internet)
  ✓ It built capacity that could be immediately used in an operational environment by all countries involved
• It opened channels between weather forecasters and disaster managers in countries where they did not exist in the past
• It highlighted the challenges in effective warning dissemination to end-users, and with disaster management structures
• Highlighted the need for enhancing in-country public responsiveness through public awareness campaigns
Thank you