SWFDP-SOUTHERN AFRICA
REGIONAL SUBPROJECT IMPLEMENTATION PLAN:
2008/2011 SOUTHERN AFRICA

(27 February 2009)

1. INTRODUCTION

1.1. Purpose

The document describes the implementation of the Severe Weather Forecasting Demonstration Project (SWFDP) in all Southern African countries. The document will be the guiding document describing practical arrangements of the operational activities in the implementation project to which the participants in the activity agree. The implementation project is a WMO project that follows on the demonstration phase of SWFDP, and is scheduled for 2008 to 2011.

1.2. Principles of the SWFDP

Numerical Weather Prediction (NWP) systems have become increasingly relevant and indeed essential to the severe weather forecasting process, with a growing number and variety of sophisticated outputs, currently available from NWP producing centres, which could be beneficial to severe weather forecasting to many National Meteorological and Hydrological Services (NMHS). The Severe Weather Forecasting Demonstration Project (SWFDP) was organized as a series of regional subprojects whose scope was to explore and test the usefulness of the products currently available from NWP centres, or products which could be readily made available from current NWP systems of global and regional meteorological centres, with the goal to improving severe weather forecasting services in countries where sophisticated model outputs are not currently used. The principal focus of the demonstration phase of the project was on the phenomena of heavy precipitation that could cause serious flooding, and strong destructive winds. The demonstration project used a cascading (forecasting) approach to provide greater lead-time for severe weather and would at the same time contribute to capacity building and improving links with Disaster Management and Civil Protection Authorities (DMCPA).

According to the recommendations of the CBS-XIII (2005), the goals of the SWFDP are the following:

- to improve the ability of NMCs to forecast severe weather events;
- to improve the lead time of alerting of these events;
- to improve interaction of NMCs with DMCPA before and during events;
- to identify gaps and areas for improvements
- to improve the skill of products from GDPFS Centres through feedback from NMCs.

1.3. The cascading process

In the framework of the general organization of the Global Data-Processing and Forecasting System (GDPFS), the SWFDP implies a co-ordinated functioning among three types of GDPFS centres. Conceptually, it should involve one global centre, one regional centre and a small number of NMHSs located within the area of responsibility of the regional

centre.

According to the conclusions of CBS-XIII, the SWFDP is an excellent way to apply the cascading approach for forecasting severe weather in three levels, as follows:

- global NWP centres to provide available NWP products, including in the form of probabilities;
- regional centres to interpret information received from global NWP centres, run limited-area models to refine products, liaise with the participating NMCs;
- NMCs to issue alerts, advisories, severe weather warnings; to liaise with DMCPAs and to contribute to the evaluation of the project.

The SWFPD will implement a cascading forecasting process aiming to ensure the real-time distribution of the relevant available information produced by both Global Centre and a Regional Centre(s) to all NMHSs. Moreover it is necessary to continue the cascade by making the final authoritative products of hazardous conditions (advisories or warnings) produced by the NMHSs available to the final users such as local Services in charge of hydrology and/or DMCPAs.

The cascading process concerns both short-range and medium-range products. In the framework of the Regional Subproject described hereafter short-range is defined as up and including day-2 while medium- range is defined as day-3 up to and including day-5.

A near real-time evaluation will be conducted, based on observations of the meteorological parameters collected at local meteorological stations as well as information gathered on the impacts of the severe weather phenomena as reported by DMCPA Services. This evaluation of the performance of the cascading process will then be provided as feedback to the participating centres to further fine tune the process itself.

1.4. The framework of the Regional Subproject in RA I

The Commission for Basic Systems (CBS) is the WMO technical commission that is responsible for the SWFDP. It developed the concepts and developed guidance materials that underpin the SWFDP through its Severe Weather Forecasting Demonstration Project Steering Group (PSG) while the implementation of the Regional Subproject in RA I was carried out through a regional technical implementation team in close liaison with the PSG.

At the CBS session in 2006, it recommended that the SWFDP should include the involvement of civil protection authorities to improve the delivery of severe weather warning services. It recognized that the SWFDP offered an important opportunity to demonstrate, learn and refine the “Cascading” process for severe weather forecasting, and that NMHSs should apply all efforts to improve their severe weather forecasting process, the methods, and warning management structures, in order to respond effectively to the needs of the disaster reduction agencies. In addition severe weather cases should be archived so that case studies could be developed to determine ways of improving all aspects of the forecasting process relevant to the specific region.

At its session in 2009, CBS continued to support the SWFDP, including its implementation in southern Africa and noted that forecasting capability will continue to improve over time as forecasters in both NMCs and RSMCs increase their knowledge and skill with increased experience and use of existing NWP/EPS products. The project was able to demonstrate:

(a) An accelerated implementation into operational use of outputs of advanced NWP/EPS systems;

(b) Continuous learning by forecasters as an effective way of capacity building;
(c) A sustainable "tight" cycle of demonstration, adapting to regional needs, evaluation, and operational implementation;
(d) Its contribution to adopting probabilistic forecasting methods;
(e) Increase in the visibility, credibility, and value of meteorological services in public and economic sectors;
(f) A possible new role of RSMCs of the GDPFS to synthesize and to provide forecasting guidance on severe weather forecasting to regional groups of NMCs.

As well, the Commission noted the importance of the services provided by NMHSs that benefit the public at large, and that the effective communication of forecasts and warnings represented a critical step in realizing the full value of the investment in improving the forecasting process. It agreed the following aspects of public weather service delivery were of high priority:

(a) Ensuring that forecasters are fully aware of the needs of each user group;
(b) Ensuring that users are fully aware of the limitations of the forecasting process;
(c) Development of improved communication skills within the forecaster community;
(d) Assessments of user satisfaction with the forecast and warning services provided by the NMHS; and
(e) Two particular user groups are of greatest importance: Disaster Management and Civil Protection Authorities (DMCPA), and the Media.

The first regional subproject in South-eastern Africa was designated to run as a demonstration from November 2006 to November 2007. Following requests from Southern African countries at Congress XV in 2007 in Geneva, and at the previous annual general meeting of MASA (the Meteorological Association of Southern Africa) in November 2008 in Swaziland, that the project is extended to all countries in Southern Africa, the SWFDP activities are now extended in a follow-up phase of the project to all sixteen countries in the coverage of RSMC Pretoria with a wider range of extreme weather hazards which occur in the region. MASA has accepted this project to be one of the key-projects in Southern Africa that it will monitor, and has encouraged all the NMHSs in the region to actively support the expansion since it is in their own best interest.

1.5. Benefits of SWFDP to Southern Africa

The benefits of the SWFDP project and its implementation to all Southern African countries are numerous. Among these are the following:

- Improvement of the early warning services in countries through the enhanced use of modern early warning technology such as NWP and ensemble prediction systems (EPS).
- Improve the early warning services to build resilience in support of disaster risk reduction
- Increase in the lead-time of warnings based on solid scientific information and guidance products.
- Increase in the support to national forecasters through the guidance products from RSMC forecasters, and additional NWP and EPS output, leading to enhanced confidence of forecasters in issuing forecasts, advisories and warnings.
- Capacity building of forecasters and thus NMHSs in using modern forecasting technology such as NWP and EPS.
- Increase in the access of forecasters from developing countries to modern forecasting information and improved forecasting systems.
- Increased collaboration between forecasters and their local disaster management and news media structures.

- Increased regional coordination between NMHSs, and also with the RSMC on forecasts, advisories and warnings.
- Opportunity to share, coordinates, and collates all weather warnings in the region.
- Enhanced severe weather warning services for the end-users including the general public
- Enhanced cooperation between RSMCs in the region
- Improved relationships between NMHSs, RSMCs and Global Centres
- Afford the opportunity to evaluate the performance of the global models including the usefulness of the products to forecasters

2. THE REGIONAL TECHNICAL IMPLEMENTATION TEAM

2.1. Responsibilities of the Members of the RTIT

The Regional Technical Implementation Team (RTIT) is set up with the aim of preparing the implementation of the project in all Southern African countries, managing and controlling its execution. The management of the Regional Subproject is the responsibility of the RTIT and within the activities of CBS. The main responsibilities of the RTIT are defined as follows:

- to prepare the Regional Subproject Implementation Plan;
- to manage the implementation of the regional subproject according to the Implementation Plan;
- to control the execution of the implementation activities;
- to report on a quarterly basis on status;
- to evaluate the project.

The members of the Regional Technical Implementation Team are appointed by the Permanent Representative (PR) of each participating NMHS and generally consist of the senior forecaster in charge of the forecasting team in the NMHS (able to direct and guide other forecasters). Each member is accountable to his/her respective PRs. The membership of the Regional Technical Implementation Team is listed in Annex A.

The tasks of the members of the implementation team, during the preparation phase of the SWFDP are as follows:

2.1.1. The lead person for each participating centre (Member of RTIT):

- to coordinate all aspects of project implementation and execution at their respective centres;
- to evaluate possible data-processing developments (e.g. work required to adjust or tailor NWP products);
- to arrange for forecasters in the centres to receive or have access to the agreed products;
- to identify related training requirements;
- To report on a quarterly basis on the status of the activities in the respective centres.

3. PRODUCTS AVAILABLE

A variety of products are available for the use of the SWFDP. Some of them are specially prepared by the global centres and the regional centres for this project. Most of the products

can easily be accessed through the web portal created for the SWFDP by the RSMC Pretoria.

3.1. Web Portal Of RSMC Pretoria

The RSMC Pretoria web portal is password protected because its main purpose is to provide weather forecast information to forecasters of the NMHSs in the region. Following the cascading process, the local forecasters use the information on the website to prepare their own forecasting products to their users and issue advisories and warnings if it is appropriate. The guidance products on the web site needs forecaster interpretation to be used effectively, and is in itself thus not aimed at users in the different countries. The web address is therefore only made available to NMHSs in the region, and to other participating stakeholders, including the participating global centres and WMO. The web portal is at:

RSMC Pretoria web portal: www.weathersa.co.za/RSMC

3.2. Products which will be provided by the Global Centres

Global NWP Products will be made available by the three global centres ECMWF, NCEP, Met-Office UK similar to what was made available for the first phase. The table of the Annex B gives the comprehensive list of the products and indicates which centre(s) will provide the NMHSs with; the list comprises mainly:

- deterministic Forecasts:6-hourly up to 48 hours, then 12-hourly up to 120 hours;
- ensemble forecasts:12-hourly up to 120 hours;
- meteograms at selected locations as discussed with the global centres.

3.3. Products which will be provided by the Regional Centre(s)

3.3.1. RSMC Pretoria:

- Provide online access to hydro-estimator (hydro-e) satellite estimates of rainfall (over the domain of SA12) at varying intervals, from 1 hour to 30 days.
- Control and maintain up to date and appropriate links to Global centres, RSMC La Reunion and other Meteorological agencies in the region, through the RSMC Pretoria web portal.
- Short-range (1-2 day) and Medium range (3 to 5 day) guidance issued by RSMC Pretoria at agreed times. Guidance products to include categorical risk assessment of extreme weather threats, narrative documents compiled by RSMC Pretoria forecaster as well as graphic maps (examples of these documents included in Annex D). These products also to be archived.
- UKMO SA12 model (12km resolution) products, across Africa south of the equator. These products to be archived as well.
- 14 day SAWS EPS maps (based on NCEP/GFS)

3.3.2. RSMC La Réunion:

- Fields given by the LAM Model running for RSMC La Réunion covering the responsibility area for tropical cyclones in the south-western part of the Indian Ocean;
- An assessment of the tropical cyclone activity in line with its activities as RSMC for tropical cyclones;
- Tropical cyclone warnings issued in the framework of the current activity of the RSMC La Réunion.
- Detailed reports concerning tropical cyclone activity in the region
- Archives of Aladin LAM products relevant to the project

3.4 Products from NMHSs

- Data are provided for use by the global and regional centres
- Warnings are issued according to country specific thresholds to DMCPAs and the public
- Quarterly reports and evaluation of the project are provided to the SWFDP secretariat
- Feedback on the quality and usefulness of products are provided to the regional and global centres

4. TRAINING

4.1. Overview

Training was delivered from 10 to 21 November 2008 to representatives of all Southern African countries (except Angola that was unable to attend) in the use of NWP and EPS products, and PWS at the start of the Southern African expansion phase of the project. The training course was hosted by the SAWS training centre in RSMC Pretoria. The aim of the training was to position operational forecasters in the participating NMHSs to take optimum advantage of the state of the art NWP model output and enable them to deliver services to partners such as DMCPAs, media as well as the general public. During the second week a disaster manager from most countries joined the PWS component of the training session in an effort to improve relationships between forecasters and disaster managers in the countries. The Met Office UK, ECMWF and NCEP as well as RSMC Pretoria contributed to the course. Future training events will build on this training course, including topics identified by the RTIT.

4.2. Training topics for the course

- Overview of the different types of atmospheric models e.g. climate, limited area, global;
- Overview on how NWP and EPS models work;
- General characteristics, strengths and weaknesses and biases of the different atmospheric models e.g. ECMWF, UKMO, GFS etc…;
- Formulating best practice techniques for the interpretation of NWP and EPS products;
- How to use probabilities in the preparation of weather forecasts;
- Nowcasting using the MSG satellite
- Interpretation of RSMC Pretoria guidance products;
- Guidance on the completion of the SWFDP evaluation form;
- Service delivery related issues in the context of PWS:
    - Building partnerships to DMCPAs, media
    - User assessment
    - Social and economic benefits of improved warning services

5. IMPLEMENTATION

5.1. Implementation at the Global Centres (work and duties)

- To provide the products, according to the lists given in Annex B, to enrich the guidance assessed by RSMC Pretoria;
- To examine the requirements of the regional centres and to propose a way to make the requested products available;
- To evaluate the time necessary to be able to complete this work;
- To indicate its level of participation in the training (essentially for medium range products, including EPS).

5.2. Implementation at the RSMC Pretoria (work and duties)

- To document and maintain lists of duties and procedures for the production process of SWFDP daily guidance by forecasters at RSMC Pretoria.
- Maintain and develop regular communication between participating centres, in terms of daily operations.
- Develop and maintain updated daily guidance documentation, taking into account the needs and requirements of participating countries.
- To contribute and participate in co-ordinating training opportunities from time to time.
- To develop and maintain reliable archiving processes for all daily guidance (for post mortem verification)
- To be the custodian of an updated list of contacts
- To assist SAWS forecasters with regular verification (in a national and regional context), as agreed to (refer to Annex J).

5.3. Implementation at the NMHSs (work and duties)

- To ensure necessary telecommunication is in place (e.g. Internet access, operational e-mail);
- to list of duties and procedures for operational forecaster (e.g. daily assess the guidance products, evaluation,);
- to develop suitable warning bulletins for DMCPA services (if not already implemented) and to agree with them on the feedback procedure.
- to be ready for archive of relevant products and information when severe weather event is either forecast or observed, as per local/national needs.
- To gather information to provide feedback on the products to regional and global centres
- To ensure that effective communication procedures are in place for interaction between national centres and with regional and global centres
- To ensure that relationships with the media are adequate and appropriate as part of service delivery functions
- To conduct annual user assessment surveys (refer Annex I)
- To conduct basic verification of warnings issued by the forecasting office (refer to Annex J)

6. NEW ACTIVITIES

6.1. Verification

The verification activities mandated under section 5 are meant to be an integral part of the operation of the project and its evaluation. They are essential to this evaluation, and are as important as other aspects. The methods selected and described in Annex J are the simplest possible to carry out which will give meaningful measures of the accuracy of the forecasts under the constraints of the project.

A few additional verification computations are outlined in Annex J which would improve the verification but imply some additional effort. These are designated "optional" in the Annex

6.2. User assessments

The NMHS's weather warning programme is designed to alert the public of weather events with potential high impact in terms of safety of life and security of property. Performance measurement of this programme is critical to the credibility of an NMHS. The effectiveness of the delivery system and communication aspects of the warning programme are as critical as the content and accuracy of the warnings. The appropriateness of the terminology and the format of the message are other important aspects of the warning process.

User-based assessment, including both the accuracy and usefulness of the warning products can be obtained through simple surveys whereby a short questionnaire can be distributed to a group of target audience or through telephone and face-to-face interviews. The questionnaire can also be posted on the NMHS website and the public be invited to fill it in on-line. Students are usually good volunteers to conduct such a survey in shopping streets or malls or carry out telephone interviews.

The questionnaire in Annex I is an example of how such a user-assessment can be designed. The results of the analysis of these surveys should form part of the reporting process and be included in the quarterly report for the April-June period of each year to the RSMC Pretoria and the WMO Secretariat.

6.3. Exchange of warnings

As part of the initiatives to enhance communication between forecasting centres of NMHSs, and with the RSMC, warnings will be exchanged in real time from the originating country to the other countries and RSMC. The method of exchange will be through the Moodle facility.

These warnings will also be made available later in a graphical format on the RSMC website for use between the groups of participants. Annex G describes the template for the exchange of warning information between countries.

7. QUARTERLY REPORTS

In order to help the RTIT track the progress of the implementation, including results achieved against the project's main goals and problems and challenges that may have arisen, regular reporting is required from the NMHSs on a quarterly schedule. The reports will include the following periods:

- November 2008 to March 2009, due 30 April 2009
- April to June 2009, due 31 July 2009
- July to September 2009, due 31 October 2009
- October to December 2009, due 31 January 2010
- Repeated quarterly to: January to March 2011, due 30 April 2011.

To assist the reporting, a template has been developed. It is to be used to guide the NMHS to provide all relevant information, and then to send it to RSMC Pretoria, by the end of the

month following the end of the quarter. The template is given in Annex F. It is highly recommended that the Quarterly Evaluation Table (annex to the template) be filled at the same time as when the Event Evaluation Report is completed for each severe weather event.

The RSMC La Réunion will report on the status of Tropical Cyclones of the Southwest Indian Ocean during the TC season, as well as any other information relevant to the project.

The RSMC Pretoria will report on the status of its implementation, including verification of the Daily Guidance Products, as well as any other information relevant to the project.

The Global products centres will report any information relevant to the project, in particular any changes to the products that are provided to the project.

8. EVALUATION OF THE PROJECT

The purpose of the event evaluation reports is:

- to provide a basis for verifying the effectiveness (accuracy, timeliness, understanding) of the forecast issued by the NMHS (comparison of forecast/warning with actual event) each time a severe weather event occurs (occurrence and intensity, lead-time, false alarm ratio, probability of detection)
- to assess the guidance issued by the Regional Centre(s)
- to acquire feedback from DMCPA services to assess impacts of the severe weather event, and usefulness of warnings/ bulletins issued

To achieve this, an event evaluation report form has been developed. It is to be filled by the NMHS and sent to RSMC Pretoria a few days after the event has taken place. A template for this report is given in Annex E, and is formatted in a convenient form for ease of transferring, processing and archiving.

9. TIMETABLE OF IMPLEMENTATION AND ACTIVITIES OF THE REGIONAL SUBPROJECT

The SWFDP – Southern Africa subproject started with the Training Workshop in November 2008, where the participant agreed that they would effectively commence the project on 24 November 2008. The major milestones for the project are as follows:

- Joint GDPFS/PWS Preparatory Training, 2 weeks, Pretoria, 10-21 November 2008): completed
- Formation and meeting of the RTIT, Pretoria, 24-27 February 2009: completed
- Quarterly reports, with due dates as noted above
- Joint GDPFS/PWS Training Workshop, tentatively November 2009
- Joint GDPFS/PWS Training Workshop and meeting of RTIT, tentatively Q3 2010
- Meeting of the RTIT, with representatives of DMCPAs, preliminary final project evaluation, 4 days, tentatively Q1 2011
- Final evaluation to be completed in Q3 2011.

10. LIST OF THE ANNEXES

- Annex A: Membership of the Regional Technical Implementation Team.
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- Annex B: List of Products provided by Global and Regional Centres.
- Annex C: Table of warning hazards and thresholds applicable to the Guidance Products
- Annex D: Example of the guidance on short-range and medium-range forecasts to be provided by RSMC Pretoria in the framework of the SWFDP (to be finalized).
- Annex E: Example of the evaluation form of the guidance provided by RSMC Pretoria (in form of an Excel file).
- Annex F: Example of the quarterly report template to be completed by NMHSs
- Annex G: Template for the exchange of warning information between centres
- Annex H: List of contact information for each participating global, regional and national centre.
- Annex I: User assessment questionnaire
- Annex J: Verification of warnings

ANNEX A: MEMBERSHIP OF THE REGIONAL TECHNICAL IMPLEMENTATION TEAM (RTIT)

COUNTRY	Representing	NAME		CONTACT
South Africa	CHAIR OF RTIT (SAWS)	Eugene **POOLMAN**	Tel: Fax: Email	+(2712) 367 6001 +(2712) 367 6189 eugene.poolman@weathersa.co.za
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Global Centres				
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National Centres				
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ANNEX B: LIST OF PRODUCTS PROVIDED BY GLOBAL AND REGIONAL CENTRES

A. ECMWF

ECMWF will provide a range of products from its high-resolution deterministic forecast and its ensemble prediction system (EPS). They are updated twice a day with forecasts from 00 and 12 UTC; an archive of the previous 6 days is also provided to assist in evaluation. All products are available in graphical format on the ECMWF web site:

http://www.ecmwf.int/products/forecasts/d/charts/medium/special/swdfp/

The web pages are password protected; user ID and password are available to all participating national weather services.

Specific products for severe weather include probabilities of heavy precipitation and strong winds. The extreme forecast index (EFI) identifies locations where the ensemble is substantially far from the model climate, alerting the forecaster to the possibility of extreme events. EPS meteograms will be provided for up to 10 stations for each participating country; the EPSgrams present a combined view of deterministic and probabilistic forecast information.

EPSgrams and ocean wave forecasts are available through the WMO user ID which each country has. Tropical cyclone predictions are available at

http://www.ecmwf.int/products/forecasts/d/tccurrent

B. NCEP

- Deliver routine NWP products (global forecast system (GFS) and global ensemble forecast system (GEFS)) via two web sites implemented as part of the USAID, and the National Weather Service through the US contributions to the WMO VCP, to provide access to the NCEP model suite. The addresses are:
  For the GFS:
  http://www.cpc.ncep.noaa.gov/products/african_desk/swdfp/day0/00/gfs.shtml
  For the GEFS:
  http://www.cpc.ncep.noaa.gov/products/african_desk/swdfp/day0/00/gfs_ensm.shtml

- Per the request of the meeting, NCEP will investigate the possibility to make available outputs from the WRF model and WRF ensemble for Africa in support of the WMO SWFDP

- Through the support to the USAID Disaster Risk Reduction Program, NCEP will provide alerts for global tropical cyclone developments.

- Pending continued support through the WMO/VCP, the African Desk will continue to host visitors in its weather section, to spend 4 months at NCEP to train on techniques for weather forecasting, case studies, and model verifications.

C. UK MET OFFICE

Met Office Deterministic Products
Met Office Global NWP model products are provided via the GTS and the Met Office Africa Limited Area NWP model products via the www.metoffice.gov.uk/weather/africa/lam/ website and via EumetCast. The deterministic NWP products disseminated are consistent with the requirements of the SWFDP RA1 Implementation plan; further products will be investigated. The Met Office Global Model also operationally supplies, under license, the lateral boundary conditions for the SAWS Limited Area Model and the Africa LAM.

It is planned to change the resolution of the Africa LAM to 12Km with more levels (the SA12 model will have additional levels, and the Africa LAM12 will be the same). The Africa LAM12 will have a reduced area to cover only Northern Africa with an overlap with the area of the SA12 model. These changes are expected in November 2009.

The SA12 LAM products will be added in 2009 to the current broadcast of Africa LAM products over EuMetCast. Details of the software upgrade required on the PUMA systems are available from Eumetsat, VCS, Corobor or the Met Office; when the software has been upgraded, Eumetsat should be asked to switch on the broadcast to the individual receivers.

Met Office Global Regional Ensemble Prediction System (MOGREPS) Products
MOGREPS data has been available via the Met Office ftp server at ftp.metoffice.gov.uk since the end of October 2006. Connecting to the ftp server has presented problems for some of the participating NMHSs so arrangements have been in place since early 2007 for the MOGREPS products to also be hosted RSMC Pretoria SWFDP website. The Met Office ftp server is due to be upgraded in 2009 to increase capacity (there is likely to be a short period of disruption to this service). The number of sites will be increased to 5 for each participating country (2 per country will be implemented immediately, with the others as capacity allows).

Met Office Tropical Cyclone Prediction Products
The Met Office offered to add a suite of tropical cyclone EPS forecasting products. The meeting requested these and they are likely to be available in July or August 2009. Dissemination will be via ftp as above.

Met Office ATD Lightning display
The Medt Office is implementing a global lightning detection system. While the accuracy in Southern Africa is limited, it will be improved in 2009 by the addition for further detectors. The data is available in map image form at http://www.met-elearning.org/atd_demo/ and a BUFR coded version of the data is being developed. It is expected that the BUFR bulletins will be disseminated over EuMetCast, ideally every 15 minutes.

Web resources
The Met Office will continue to fund the http://www.met-elearning.org/moodle/ website. This currently supports a training area; while the activity is currently low, the meeting requested that this continue. A new area has been set up to provide a forum for the exchange of warning messages between forecasting offices.

D. RSMC PRETORIA:

- Guidance products are prepared daily for the next five days for the entire Southern Africa region in line with the SWFDP demonstration phase:
    - Five maps (one for each of the next five days) are produced indicating areas where a weather hazard is expected to exceed the agreed threshold.
    - A text weather discussion is produced daily for the short-term (days 1 and 2) and another one for the medium-term (days 3 to 5) describing the most prominent expected weather patterns and arguments for the proposed threat areas.
    - A Short-range Risk Table (days 1 and 2) and Medium term Probability Table (days 3 to 5) are also produced to indicate the risk (or probability on the medium term) of the threat in particular countries as it is assessed by the guidance forecaster at the RSMC.
- NWP: Products from the regional limited area Unified Model running at the South African Weather Service (SAWS) are also made available through the website. This SA12 UM model gets its lateral boundary values from the Met Office, completes 3dVar data assimilation and runs a 12 km resolution 48 hour forecast daily over Africa South of the equator, and products are on the same resolution.
- Satellite based products: The NCEP Hydroestimator as it is adapted by Eumetsat was installed by Eumetsat at the SAWS to utilize the high resolution of the Unified Model. The Hydroestimator calculates satellite rainfall, using humidity and profile input from the SA12 Unified Model, at a 15 minute time resolution. Various accumulated rainfall totals (1 hour, 6 hours, 24 hours, etc) are also made available on the RSMC web portal.
- Tsunami warnings issued by the Japanese Meteorological Agency (JMA) and by NOAA are dissemination via the GTS and received in RSMC Pretoria. These bulletins will also be available on the RSMC Pretoria web portal.
- All guidance products and SA 12 UM fields are archived by RSMC Pretoria for future reference.

E. RSMC LA REUNION

- Fields given by the LAM Model running for RSMC La Réunion covering the responsibility area for tropical cyclones in the south-western part of the Indian Ocean;
- An assessment of the tropical cyclone activity in line with its activities as RSMC for tropical cyclones;
- Tropical cyclone warnings issued in the framework of the current activity of the RSMC La Réunion.
- Detailed reports concerning tropical cyclone activity in the region
- Archives of Aladin LAM products relevant to the project

ANNEX C: TABLE OF WARNING HAZARDS AND THRESHOLDS APPLICABLE TO THE GUIDANCE PRODUCTS

A representative list of severe weather hazards and the relevant thresholds will be used to prepare guidance products for the entire regions by the RSMC Pretoria guidance forecasters. This does NOT imply that local, in country, warning systems must use the same thresholds for an NMHS to issue warnings. Each country has its own thresholds based on good, historical reasons. However, the guidance forecasts will use a representative threshold for each hazard designed in such a way that it will draw the attention of forecasters of all NMHSs to potential hazards threatening their region. This will help the NMHS to decide if the threat is real and monitor it for proper advisory or warning actions as determined in their particular countries. In the SWFDP demonstration phase only two hazards (heavy rain and strong winds) were monitored. However, in the expansion phase a number of other hazards are also monitored.

The meteorological hazards of concern in this region are those for which NMHSs issue warnings to the public at large. This approach recognizes the decisions by governments, through their respective NMHSs, to have set threshold criteria for official weather warnings. At the same time it is recognized that some other meteorological phenomena could have significant impact on the public, such as heat waves or rapid temperature changes. There are also some hazardous phenomena for which there is presently no methodology for supporting a RSMC Guidance.

Table 1. The hazards for the SWFDP that will be monitored by RSMC Pretoria for a lead time up to 5 days and included in the guidance products are listed here with related thresholds. Conditions associated with tropical cyclones (heavy rain, strong wind, high seas) expected to impact land areas will indicate the tropical cyclone association using the forecast issued by RSMC La Reunion.

HAZARD	THRESHOLD	COMMENTS
Heavy Rain	≥50 mm in 6 hours ≥50 mm in 24 hours ≥100 mm in 24 hours	The operational country-thresholds differ widely between countries.
Strong winds	≥20 knots ≥30 knots	Affecting oceanic and coastal areas. Gusts on land from severe convective systems are not predictable on this time scale effectively
High seas (Oceanic)	>2.5 m average swell or wind waves for the Tropical Indian Ocean (Rough seas); >4 m swell or wind waves (very rough seas) >7 m swell or wind waves (extremely rough seas)	A particular threat to island states, but also to other coastal communities, different thresholds have different disastrous impacts on the coastal structures in the region.
Severe convective storms	Occurrence (days 1 & 2) Criteria (one or more of): hail >19mm diameter, Strong winds >50 knots, tornado	This is not skilfully predictable on the medium-term (days 3 to 5).
Very cold conditions	≤10˚C maximum temperatures	A hazard mostly for the southern countries in the region.
Snow	Occurrence of snow on high-lying areas, consider a threshold also for accumulated amount	A winter hazard for the southern countries in the region.
Flooding	Where general comments could be made of high certainty regarding potential flooding	Proper tools to determine areas of flooding at the larger scale lack at this moment

ANNEX D: EXAMPLE OF THE GUIDANCE ON SHORT-RANGE AND MEDIUM-RANGE FORECASTS TO BE PROVIDED BY RSMC PRETORIA IN THE FRAMEWORK OF THE SWFDP

GUIDANCE TO BE ISSUED BY THE RSMC PRETORIA TOWARD THE NMHSs FOR SHORT RANGE SEVERE WEATHER FORECASTING UP TO 48 H

The SW Short guidance comprises three parts :

- Part A: Text; depiction of the expected evolution of the weather up to 48 h and comments about the more representative short range products that are used with reference to figures included in the part B or to charts clearly identified (model, parameter, level, forecast range).

- Part B: Figures; charts or graphics coming essentially from deterministic models (global or LAM).

- Part C: The assessment of the degree of confidence of the forecast by the forecaster.

- Part D: Two tables (for 24 h and 48 h, respectively), summarizing the risk of severe weather as assessed by the RSMC Pretoria as proposed below. In order to provide more information about the geographical location of the severe event the following convention is adopted when filling in the cells : X for the whole country, N for the northern part, S for the southern part, W for the western part and E for the eastern part.

Country	No risk	Low risk	Medium risk	High risk
Botswana	Heavy precip.			
	Strong Winds		N	
Mozambique	Heavy precip.			
	Strong Winds	X		
Etc…				

This table is only an example and has to be definitively defined by the RSMC Pretoria. The separation of the evaluation of the risk into four categories (no risk, low risk, medium risk and high risk) is only given as an example.

- Part E: Two geographical maps (for 24 h and 48 h, respectively) including the boundaries of the countries with contours identifying the areas which are likely to be hit by the severe weather event.

- Part A :Text; depiction of the expected evolution of the weather for days 3, day 4 and day 5 and comments about the more representative medium range products that are used with reference to figures included in the part B or to graphics clearly identified (EPS charts or meteograms).
-
- Part B: Figures; charts or graphics coming essentially Ensemble Prediction Systems (EPS).

- Part C: The assessment of the degree of confidence of the forecast by the forecaster.

- Part D: Three tables (for day 3, day 4 and day 5, respectively), summarizing the probabilities of precipitation and wind higher than a given threshold as proposed below. In order to provide more detailed information about the geographical location of probabilities the following convention is adopted when filling in the cells : X for the whole country, N for the northern part, S for the southern part, W for the western part and E for the eastern part.

Country	Risk	No Risk	Low Risk	Medium Risk
Botswana	**Prec.> 50mm/6h**	**N**		
	Winds > 30 kt		**N**	
Mozambique	**Prec.> 50mm/6h**	**X**		
	Winds > 30 kt			**X**
Etc…				

This table is only an example and has to be definitively defined by the RSMC Pretoria(number of columns, lower and upper limits).

- Part E: Three geographical maps (for day 3, day 4 and day 5, respectively) including the boundaries of the countries with contours identifying the probabilities areas for the occurrence of the weather event.

ANNEX E: EXAMPLE OF THE EVALUATION FORM OF THE GUIDANCE PROVIDED BY RSMC PRETORIA

EVENT EVALUATION REPORT FORM
Page 1 of 2

SEVERE WEATHER EVALUATION

INSTRUCTIONS: :

1. This form must be filled in whenever: (1) Severe weather is observed (Sections A and B)
   (2) A warning has been issued to DMCPA (Sections A and C)

2. Email the completed document to RSMC Pretoria, WMO and other agreed recipients
   To standardize please put the title "SWFDP Evaluation Form" in the title list of the email

A. IDENTIFICATION OF THE SEVERE EVENT

NMHS:		Alphabetic	
Region affected:		Alphabetic	
Event Number:		Numeric	
Type of event:		Numeric	(put the right number in the cell)

1: Heavy Precipitation 2: Strong wind 3: High seas 4: extreme rough seas
5: occurrence of severe thunderstorms 6: very cold temperatures 7: occurrence snow

Severe convection		Numeric	(put 1 if extreme phenomena are the consequence of severe convection or 0 otherwise)

B. SEVERE WEATHER OBSERVED **(to be completed even if no severe weather has been forecast)**

	JJ	MM	DD		HH	MM	
Start of the event:				at			UTC
End of the event:				at			UTC

Occurrence or Max. observed value:			Unit
(Include all severe weather phenomena)	Numeric	Alphabetic	

Information from the end-users
short text explaining the consequences and possibly some figures
(number of interventions, casualties, damages, usefulness of the warning)

EVENT EVALUATION REPORT FORM
Page 2 of 2

C. SEVERE WEATHER FORECAST **(to be completed even if severe weather did not occur)**

		JJ	MM	DD		HH	MM	
Time of the warning	toward DMCPA				at			UTC
Start of the event;	forecaster assessment				at			UTC
End of the event;	forecaster assessment				at			UTC

Level of risk from RSMC Daily Guidance (enter "1" in the chosen cell)

		No	Low	Med.	High
Level of risk	1 day before:				
Level of risk	2 days before:				

Level of risk from medium-range RSMC Daily Guidance

		No	Low	Med.
Level of risk	3 days before:			
Level of risk	4 days before:			
Level of risk	5 days before:			

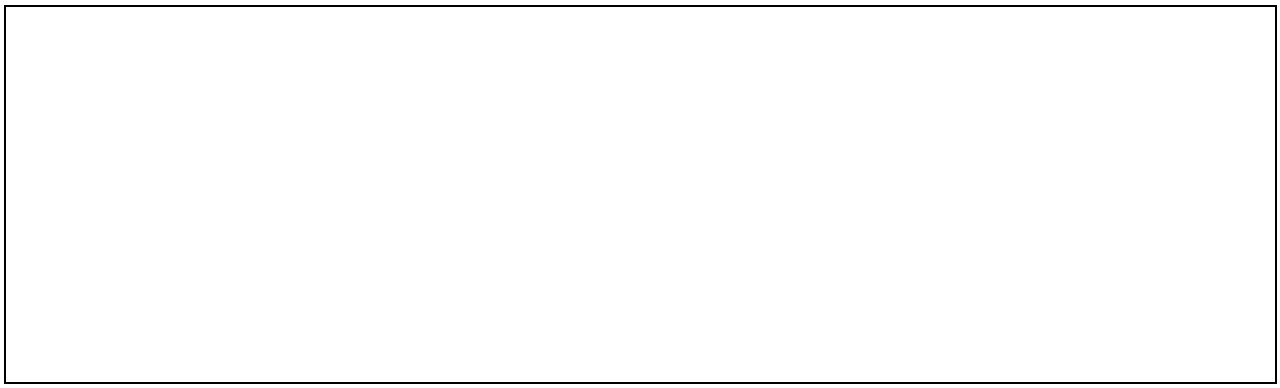
Usefulness of products (use Key and enter code in the chosen cell)

	Guidance
RSMC Pretoria	

Key:
A = Very useful (basis of the warning)
B =Useful (aided warning confidence)
C = Neutral (not useful)
D = Negative (misleading)
X = Not used

	NWP	EPS
ECMWF		
NCEP		
Met Office		

Comments including information on usefulness and applicability of used tools



ANNEX F: EXAMPLE OF THE QUARTERLY REPORT TEMPLATE TO BE COMPLETED BY NMHSS

QUATERLY REPORT OF THE REGIONAL SUBPROJECT
PERIOD: (Start date to end date)
XXX 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	**PROGRESS AGAINST GOALS**
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

   A) Feedback from the public
   B) Feedback from the DMCPA to include comments of the timeliness and usefulness of the warnings
   C) Feedback from the media
   D) Warning verification by the NMCs

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 G: TEMPLATE FOR THE EXCHANGE OF WARNING INFORMATION BETWEEN CENTRES

Country	Valid from: Date	Time (hour) UTC	Valid to: Date	Time (hour) UTC	Hazard Classification (for example Flood, Heavy rain, strong wind, rough seas, severe storms, very cold, snow, other)	Free Text

ANNEX H: LIST OF OPERATIONAL CONTACT INFORMATION FOR EACH PARTICIPATING REGIONAL AND NATIONAL CENTRE

OPERATIONAL CONTACT INFORMATION

Country	Office/Designation/Name	Email(s)	Telephone	Fax
South Africa	RSMC Pretoria (SWFDP Guidance Centre)	rsmc@weathersa.co.za	+27 12 367 6034	+27 12 367 6042/3
France	RSMC La Reunion (Tropical Cyclone Centre)	Yassine.kadri@meteo.fr Matthieu.plu@meteo.fr Philippe.caroff@meteo.fr	+262 262 92 1100	+262 262 92 1147
Angola	National Forecasting Centre Instituto Nacional Meteorologia Senior Forecaster/Francisco Osvaldo Neto	Inamet@nexvs.ao	+222 251951 +923 302387	
Botswana	Central Forecasting Office/ Sacrasta Nchengwa or P Phage (Director)	snchengwa@gov.bw fforecasting@gov.bw	+267 3612282/3 +267 3612298	+267 3956282/ +267 3953617
Comoros	Ibrahim Kassim (interim contact)	kassim@comorostelecom.km	+269 333 2135	+269 773 2613
Republiqique Democratique du Congo	Donatien Musungayi (Interim contact) Mettelsat	Actioneaa2002@yahoo.fr	+243 998416566	
Lesotho	Weather Forecasting Office Meteorologist (officer in charge)/Charles Tseole	charlestseole@yahoo.com charles1970@excite.co.uk weather@lesmet.org.ls	+266 223 50732 +266 223 25057 +266 223 17250 +266 581 05424	+266 223 50325 +266 223 25057 (mobile)
Madagascar	Direction de la Meteorologie B.P. 1254 Antananarivo	Meteo.dem@moov.mg	+261 2022 40823	+261 2022 40823 +261 2022 40581
Malawi	National Met Centre	nmc@metmalawi.com	+265 182 2106	+265 182 2215
Mauritius	Mauritius Meteorological Services	meteo@intnet.mu	+(230) 686 1031	+(230) 686 4746

		meteo.mru@intnet.mu		
Mozambique	National Forecasting Centre Intituto Nacional de Meteorologia / Senior Forecaster/Sergio Buque	Centro_o@inam.gov.mz Sergio_b@inam.gov.mz	+258 21 490148 +258 21 465138 +258 82 8387250	+258 21 490 148 +258 21 491 150
Namibia	Namibia Meteorological Service/Senior Forecaster/Olga Karunga-Tjiueza	karungao@meteona.com	+26462540327 +26462540059	+26462540027
Seychelles	Seychelles National Meteorological Services	forecaster@pps.gov.sc	+248 384070	+248 384078
South Africa	Senior Forecaster South African Weather Service	nms_forecasting@weathersa.co.za	+27 12 367 6034	+27 12 367 6042/3
Swaziland	Central Forecasting Office/Senior Forecaster/Phephisa Sihlongonyane	forecast@swazimet.gov.sz jabulani@swazimet.gov.sz phephisa6@gmail.com	+268 404 9468 +268 404 6274 +268 606 0245	+268 404 1530
Tanzania	Tanzania Meteorological Agency	met@meteo.go.tz	+255 222460735 +255 222460772	+255 222460735
Zambia	Zambia Meteorological Department	zmd@zamnet.zm zmd@coppernet.zm	+260 211 251912 +260 211 252728	+260211252728
Zimbabwe	Zimbabwe Meteorological Services Department	severewx@weather.utande.co.zw	+263 4 778173-6	+263 4 778 161

ANNEX I: USER ASSESSMENT QUESTIONNAIRE EXAMPLE

NMHS…..(country) User Assessment Survey

Q1. From where do you usually obtain weather information of your country?

1. Radio
2. Television
3. Newspaper
4. Directly from the Met Service
5. Met Service Home pages
6. Other home pages
7. Mobile phones
8. Other sources (specify)

Q2. Do you consider the **warnings** of severe weather of your country over the past several months accurate or inaccurate?

1. Very accurate
2. Somewhat accurate
3. Average
4. Somewhat inaccurate
5. Very inaccurate
6. Don't know/no comments

Q3. How easy is it for you to understand the format, and the language used in the **severe weather warnings**?

1. Very easy
2. Easy
3. Neutral
4. Difficult
5. Very difficult
6. Don't know/no comment

Q4. How do you compare the current severe weather warnings with those from the past 2 years?

1. More accurate
2. About the same
3. Less accurate
4. Don't know/no comments

Q.5 Are the severe weather warnings useful in helping you decide on appropriate response action (e.g. stay at home, do not take the car out of the house, keep children indoors, etc)?

1. Yes
2. No

Q5. On the whole how satisfied are you with the severe weather warnings provided by your country?

1. Very satisfied
2. Satisfied
3. Neutral
4. Dissatisfied

5. Very dissatisfied
6. Don’t know/no comments.

ANNEX J: PROCEDURES FOR VERIFYING WARNINGS USING CONTINGENCY TABLES

1. VERIFICATION OF WARNINGS ISSUED BY NMSS.

1.1. MATCHING FORECASTS AND OBSERVATIONS

- -Each individual warning defines the predicted event, and should include the threshold (e.g. >50 mm rain), the valid period (e.g. 24 h from 06 to 06 UTC), and the location(s) for which it is valid.

- -If a severe event is reported within the time range and within the location range specified by the warning, then a hit is registered. (Fcst=Obs=Yes)

- -If more than one severe event is reported, both inside and outside the warning area and/or time range then two events are defined, a missed event and a hit, and each is given a weight of 0.5.

- -If no event is reported during the valid period and valid area of the warning, then a false alarm is registered. NMSs should make every effort to determine unambiguously whether or not forecast severe weather occurs within the valid space and time range, so that missing observations are not recorded as negatives. (Fcst=Yes; Obs=No)

- -If an event is reported, and there is no valid warning in force, then a missed event is recorded. (Fcst=No; Obs=Yes)

- -Any inactive day is recorded as a single correct negative (Fcst=Obs=No)

1.2. SETTING UP THE TABLE

Data can be set up by means of an Excel (or other format) as in the example below. If there is more than one warning issued on a given day, each warning is considered and verified as a separate event.

Date	Event	Fcst to occur?	Observed ?
	1	Yes	Yes
	2	No	Yes
	3	No	No
	4	Yes	No
	5	No	No
	6	Yes	Yes
	7	No	No
	8	No	Yes
	9	No	No
	etc		

In the data table “1” can be used for “yes” and “0” for no. Once the data table is constructed, the four boxes of the contingency table can be tallied.

The table should include the marginal sums of forecast and observed events, and the total events in the sample,

	Obs - Yes	Obs - No	Totals
Forecast – Yes	Hits a	False Alarms b	Total Events Fcst = a+b
Forecast – No	Misses c	Correct Negatives d	Total non-events Fcst = c+d
Totals	Total events observed = a+c	Total non-events observed = b+d	Total sample size T=a+b+c+d

As a minimum, the table should be computed for categorical forecasts. Where probabilistic or "risk" information is forecast, then separate tables can be computed from the same dataset, considering each level of risk as a separate threshold for a categorical prediction. (Example contained in the Nov-March 09 report from Madagascar)

Different forecast "events" (precip >50 mm/24h; windspeed >30 kt etc) should be verified using separate tables. Even if the sample is small, the tables and their statistics can be computed. Tables need not be computed if the aggregated total number of occurrences or warnings issued is fewer than 5. However, tables should be updated from the previous quarter and reported whenever any warnings are issued or any severe events are observed.

The following scores should be computed from the contingency tables:

1. Probability of Detection (Hit rate)
2. False Alarm ratio
3. Threat score
4. Frequency bias

And, optionally,

5. Heidke Skill score
6. Extreme Dependency Score

Equations for all these scores are contained in the Power point presentation on verification from the Feb 24 to 27, 2009 meeting or from the websites referenced in that same presentation.

1.3. REPORTING

The contingency tables should be contained in each quarterly report. The data period should start when forecast and observation data were first archived, and the tables should be aggregated over one year, updated for inclusion in each quarterly report.

2. Verification of graphical guidance products from RSMCs, using the Hydro Estimator data.

It is suggested that the RSMC Pretoria heavy precipitation guidance products be verified graphically, and manually, using the Hydro Estimator (HE) data. It

should be remembered at all times that these data are not true observations, but estimates based on a combination of satellite data and estimated parameters from the UK model. Their use as “observations” is warranted due to the lack of traditional station observations. Wherever precipitation observations can be obtained, these should also be used to “ground-truth” the satellite-based estimates.

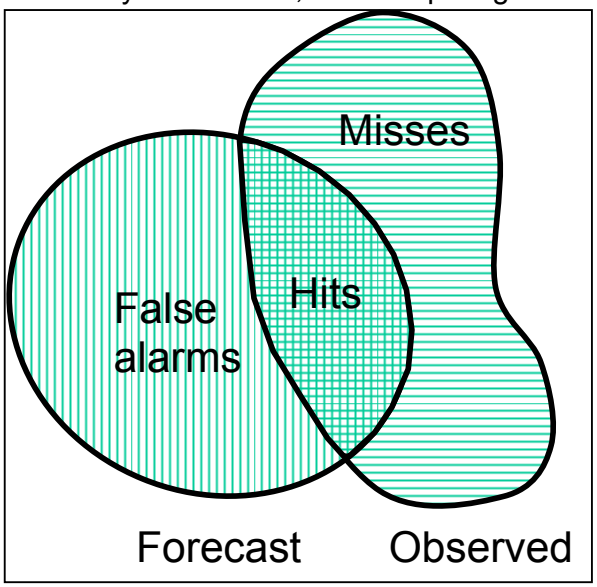
Areas on the forecast maps should be matched to areas on the HE maps following the schematic below. This should be accomplished by overlaying a grid of equal-area rectangles, and counting the number of rectangles which represent false alarms, hits and misses. This process will be easiest if either the forecast maps or the observation maps are remapped to match the other. Correct negatives need not be calculated. Totals of the boxes should be added over all days of the verification, separately for forecast projections of day 1 to 5, to form contingency tables as above, leaving “correct negatives” blank. Then, the following scores should be computed:

1. Probability of Detection (Hit rate)
2. False Alarm Rate
3. Threat Score.

Optionally, correct negatives could be computed as the total number of boxes in the domain (constant) minus the total number covered by severe weather forecasts and/or observations, and a full table computed. Then,

4. Frequency bias and
5. Heidke Skill score,

could also be computed. The usefulness of the probabilistic information can be evaluated by stratifying the forecasts by level of risk, and computing separate tables for “high risk”, “at least moderate risk” (moderate +high), and “at least low risk”(low + moderate+ high), calculating hit rate, and false alarm RATE (=b/(b+d)) and plotting them as shown in the verification power point. This is also optional, though would not involve much additional work once the tables are generated.



These results should also be reported at each quarter, but aggregated over a year.