

WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR BASIC SYSTEMS

SEVERE WEATHER FORECAST DEMONSTRATION PROJECT (SWFDP)

GUIDEBOOK ON PLANNING REGIONAL SUBPROJECTS



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CBS SEVERE WEATHER FORECAST DEMONSTRATION PROJECT (SWFDP)

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1 - Purpose of the Guidebook

The purpose of this SWFDP Guidebook is to provide participating centres in the Project with the basic information they need to guide in the planning and the organization of a SWFDP regional subproject. The Guidebook includes an introductory section then explains how to prepare the subproject and the expected milestones during its execution.

2 - General Introduction

2.1 - Objectives of the SWFDP

2.1.1 - The scope of the Severe Weather Forecast Demonstration Project (SWFDP) is to test the usefulness of the products currently available from NWP centres, or products that could be made available from current NWP systems, with the goal to improve severe weather forecasting services in countries where sophisticated model outputs are not currently used. Such a demonstration project would use 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 or civil protection authorities.

2.1.2 - According to the recommendations of the CBS-XIII (2005) the goals of the SWFDP are defined as follows:

- 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.

(DMCPA – disaster management and civil protection authorities)

2.2 - The Cascading Process

2.2.1 - 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.

2.2.2 - According to the conclusions of CBS-XIII, the proposed 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 disaster management and civil protection authorities; and to contribute to the evaluation of the project.

2.2.3 - Each centre will be required to tailor the list of products to the requirements of the particular regional subproject. A list of possible products to be exchanged between the centres is given in Annex A of this Guidebook for a regional subproject whose severe weather focus is not associated with Tropical Cyclones, and in Annex B of this Guidebook for a regional subproject whose severe weather focus is associated with Tropical Cyclones.

2.3 - Expected Benefits

2.3.1 - The SWFDP will provide the opportunity to encourage forecasters to use and experiment with standard products and recommended procedures, which have already been introduced in GDPFS centres and which could be relevant to a number of NMHSs that have not yet used them.

2.3.2 - The SWFDP aims to demonstrate the benefits of applying the cascading process for severe weather forecasting in the NMHSs, with the intention of not incurring research and development costs. It is viewed as way to explore how the concept could benefit several NMHSs in the same geographical region.

2.3.3 - It is also expected that the SWFDP would help strengthen the links between the NMHS and the DMCPA and then to increase the efficiency and effectiveness of the public warning services in case of severe weather events.

2.3.4 - In relation to the THORPEX (The Observing System Research and Predictability Experiment) research and development programme, it is hoped that implementation of SWFDP regional subprojects represents an opportunity to prepare NMHSs and GDPFS centres to be better prepared to accommodate the implementation of the outcomes of this research and development programme.

2.4 - Responsibilities of the Centres in the Framework of the Cascading Process

Specific tasks are attributed to the three types of centres participating to the SWFDP in the cascading process.

2.4.1 - The Global Centre

- to provide the other centres with medium-range NWP guidance and EPS products including probabilistic forecasts;
- to evaluate the efficiency of products dedicated to medium-range severe weather forecasting through the feedback provided by the other centres.

2.4.2 - The Regional Centre

- to redirect toward the NMHSs relevant products issued from the global centre (if necessary);
- to provide NMHSs with its own interpretation of the medium-range guidance, including EPS products;
- to provides the NMHSs with the short-range NWP guidance (including products adapted to severe weather events), as frequently as possible;
- to issue a severe weather bulletin summarizing interpretation of NWP products with respect to severe weather over the responsibility area of the NMHSs;
- to evaluate its own interpretation of EPS products as well as its NWP guidance.

2.4.3 - The National Meteorological Centre of the NHMS

- to liase with DMCPA service and establish contacts with it prior and during severe weather events;
- to interpret the guidance provided by the global centre and the regional centre;
- to issue special bulletins and warnings as required by the end users (hydrological services, DMCPA services, media...) when severe weather is expected;
- to obtain feedback from users;
- to perform an evaluation of the cascade approach from a weather forecaster's perspective;
- to provide feedback to regional centre on usefulness and skill of products.

3 - Preparation of Regional Subproject

3.1 - Subproject Approval

The establishment of a regional subproject requires a formal agreement from the participating centres. The WMO Secretariat sends the invitation to participate:

- to the RA President, to seek his consent,
- to the Heads of the participating centres, to request their commitment.

3.2 - Setting up of a Management Structure

A regional subproject management team is to be set up with the aim of preparing the implementation of the project and managing and controlling its execution.

3.2.1 - Role of the Regional Subproject Management Team

The responsibilities of the regional subproject management team are defined as follows:

- to prepare the Regional Subproject Implementation Plan;
- to manage the implementation of the regional subproject;
- to control the execution during the field phase;
- to evaluate the system.

3.2.2 - Members of the Regional Subproject Management Team

The Regional Subproject Management Team comprises the following members:

- a regional subproject Chairperson;
- a lead person in each of the participating centres;
- a Project Steering Group (PSG) contact person.

3.2.3 - Designation of the Regional Subproject Management Team Members

The designation of the members of the Regional Subproject Management Team is carried out through the following processes:

- The WMO Secretariat requests the RA President for designation of a subproject chairperson;
- The Project Steering Group (PSG) chairman designates a contact person from PSG;
- The regional subproject chairperson requests each participating centres for designation of a lead person.

3.2.4 - Responsibilities of the Members of the Regional Subproject Management Team

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

The chairman or the management team:

- to draft a detailed regional project development plan and to share between participating countries;
- to co-ordinate training requirements that support the demonstration project and to provide information to WMO Secretariat;
- to report on the project.

The lead person for each participating centre:

- 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 training requirements.

3.3 - Regional Subproject Implementation Plan

3.3.1 - Required Regional Subproject Milestones

The Management Team is responsible for the elaboration of an implementation plan for the regional subproject. The regional subproject implementation plan must include the following actions with milestones:

- Submit a project implementation plan to the Project Steering Group (PSG);
- Convene a kick-off meeting to develop the implementation plan (including defining the results and measures of success);
- conduct preparatory training for participants;
- start of the field phase;
- conduct mid-term project review;
- submit the final report to PSG.

3.3.2 - Technical Preparation

In the technical preparation of the SWFDP regional subproject, the Management Team needs to finalize the list and the frequency of the products to be exchanged between the concerned GDPFS centres and to finalize the details of the evaluation procedures. It is also essential to verify that existing telecommunication and data-processing capability and capacity allow the transmission and display of the SWFDP requested information. If it is necessary to implement new tasks, the additional work must be carefully evaluated for consideration and decision by the Management Team.

3.3.2.1 - Products to be Exchanged

To assist participating centres in the demonstration project to define the products to be exchanged a sample list for consideration in the forecasting of severe weather not associated with Tropical Cyclones is given in the Annex A of this Guidebook, and a sample list for consideration in the forecasting of severe weather associated with Tropical Cyclones is given in Annex B of this Guidebook.

3.3.2.2 – Routine Evaluation Procedure

Information for the purposes of evaluation will be required, and collected in a way that is relatively brief and straightforward in order to ensure that it is reliably completed on a regular basis. It is proposed that the information for the evaluation be collected by using a prepared questionnaire to ensure consistency and to allow rapid completion. The questionnaires are to be completed first at the NMHSs and then passed on to the regional centres for them to add their information to the evaluation and then to the global centres for their information and comments. The way the evaluation is to be performed as well as a sample template of the questionnaire are given in Annex C to this Guidebook.

3.3.2.3 - Telecommunications

It is necessary to verify that the existing telecommunication means are capable to transmit the full amount of information in a timely manner as agreed between the centres participating to the demonstration project. This includes both the current GTS capabilities and Internet access for displaying web pages or for file transmission using FTP. If the amount of data to be transmitted exceeds the capabilities of the existing telecommunication means it will be necessary to reduce the list of products to be exchanged. However, with regards to the duties of the NMHS, it is particularly important to ensure that the transmission of the weather warnings to the DMCPA services is carried out without delay.

3.3.2.4 - Data-processing Capabilities

The data-processing capabilities of each of the centres have to be able to produce and provide the forecasters with the products transmitted to it by the “upstream” centre. Depending on the kind of products, the exchange of new products may imply some additional workload in the regional centres and in the NMHSs. Storage capacity has also to be considered to allow the saving of the relevant products and information for project evaluation purposes.

3.3.2.5 – Training

Some training will probably be necessary to be sure that forecasters from regional centres and NMHSs are able to correctly interpret the various products exchanged during the field phase of the SWFDP. It is important to note that special training session devoted to a regional subproject could be planned in conjunction with existing training programmes, for example organized by WMO Secretariat or WMO Members.

3.3.3 - Planning of the Organizing Meetings

The SWFDP, in its application of a cascading process, implies close cooperation and coordination between the centres. The regional subproject implementation plan should include:

- a kick-off meeting of the Regional Subproject Management Team to clearly and precisely define the work to be carried out in each participating centre;
- a preparatory training session for participating forecasters;
- electronic correspondence as the principal ongoing method for project management and control

3.3.4 - Evaluation of the Regional Subproject Costs

The cost evaluation of the SWFDP regional subproject will be carried out on the following way:

- the Regional Subproject Management Team provides costing for all aspects of the subproject, which would mainly be incurred for holding meetings and conducting the training;
- the Project Steering Group (PSG) reviews the costing.

ANNEX A

SAMPLE LIST OF PRODUCTS TO BE EXCHANGED IN A REGIONAL SUBPROJECT FOR FORECASTING SEVERE WEATHER NOT ASSOCIATED WITH A TROPICAL CYCLONE

1 - Data and Products issued from the Global Centre to the other Centres.

Products which are not routinely transmitted through the GTS should be provided in graphical form (Web pages) via Internet for rapid display and dissemination, and may also be made available by other methods (e.g. FTP).

1.1 - Current Deterministic NWP Fields up to 7 days – at 6-h Intervals up to 3 days, 12-h intervals after 3 days).

The recommended products include:

- charts to depict the large-scale flow (e.g. 500 hPa , 700 hPa, 850 hPa geopotential height, 850 hPa temperature, upper air winds, MSLP);
- surface weather elements (e.g. 6-hour accumulated precipitation, surface (10m) wind-speed).

1.2 - Probabilistic Forecast Products based on EPS

- probability of severe weather events such as precipitation and wind higher than given thresholds;
- “spaghetti” plots (e.g. 500 hPa geopotential height in extra-tropics, precipitation and wind higher than given thresholds);
- stamp maps (e.g. streamlines in the tropics, wind speed, accumulated precipitation);
- dispersion diagrams (plumes and EPSgrams) for weather elements at specific locations;
- representative members of a classification of weather pattern such as clustering or tubing (optional product depending on possibilities of Global Centre);
- severe weather risk index such as Extreme Forecast Index (where available).

2 Data and Products issued from the Regional Centre to the NMHS

Products which are not routinely transmitted through the GTS should be provided in graphical form (Web pages) via Internet for rapid display and dissemination, and may also be made available by other methods (e.g. FTP).

2.1 To the NMHSs

2.1.1 - Interpretation of products from the global centre and commentary (severe weather bulletin), containing (as required);

- interpretation of EPS products;
- severe weather forecast.

2.1.2 - Current deterministic Limited Area Model fields up to 2 days at 6-hour intervals

Products could include, for example:

- charts to depict the large-scale flow (e.g. 500 hPa, 700 hPa, 850 hPa geopotential height, 850 hPa temperature, tropopause height, upper air winds, MSLP);
- surface weather elements (e.g. 6-hour accumulated precipitation, surface (10m) wind-speed and gusts (if available), 2m temperature, 850 hPa specific humidity);
- maps of vertical motion, potential vorticity or height of specified PV surface;
- maps of convective indices such as CAPE, Lifting Index, helicity...;
- relevant satellite images (where NMHSs do not have satellite receiving capability);
- special products derived from satellite images (e.g. derived precipitation or images annotated with guidance notes).

Frequency of products and minimum products set for daily distribution should be decided at the kick-off meeting.

2.2 Toward the Global Centre

- Copy of severe weather bulletins for information.

3 - Data and products issued from the NMHS(s)

3.1 Toward the users (hydrological services and/or DMPCA services).

Products should be agreed in the planning stage of the project according to the needs of the users, but might typically include:

- outlook bulletin for potential threats ahead;
- warning bulletin in case of severe weather, including information on probability;
- additional specific maps (if necessary).

3.2 Toward the Regional Centre

- Acknowledgement of the severe weather bulletin;
- Near-real-time information on events (including false alarms and non-forecast events).

ANNEX B

SAMPLE LIST OF PRODUCTS TO BE EXCHANGED IN A REGIONAL SUBPROJECT FOR FORECASTING SEVERE WEATHER ASSOCIATED WITH A TROPICAL CYCLONE

1 - Data and products issued from the Global Centre to the other Centres.

Products which are not routinely transmitted through the GTS should be provided in graphical form (Web pages) via internet for rapid display and dissemination, and may also be made available by other methods (e.g. FTP).

1.1 - Current Deterministic NWP Fields up to 7 days - at 6-h Intervals to 3 days, 12-h intervals after 3 days.

The recommended products include:

- charts to depict the large-scale flow (e.g. 850 hPa, 750 hPa, 500 hPa, 200 hPa wind flow and relative humidity, 500 hPa geopotential height, MSLP, surface streamlines);
- charts to assist with forecasts of tropical cyclone formation, movement and intensification (e.g. 850 hPa, 200 hPa relative vorticity and convergence, 850-400 hPa deep layer mean flow, 850-200 hPa vertical wind shear, vertical motion);
- surface weather elements (e.g. 6-hour accumulated precipitation, surface (10 m) wind speed).

1.2 - Probabilistic Forecast Products based on EPS

- surface or 850hPa vortex track charts;
- tropical cyclone position fix and track forecast spread (strike probability);
- probability of precipitation and wind higher than given thresholds;
- tropical cyclone formation probability;
- "spaghetti" plots (e.g. 500 hPa geopotential height in extra-tropics, precipitation and wind higher than given thresholds);
- stamp maps (e.g. streamlines in the tropics, wind speed, accumulated precipitation);
- dispersion diagrams (plumes and EPSgrams) for weather elements at specific locations;
- representative members of a classification of weather pattern such as clustering or tubing (optional product depending on availability of Global Centre);
- severe weather risk index such as Extreme Forecast Index (where available).

2 - Data and Products issued from the Regional Centre to the NMHS

Products which are not routinely transmitted through the GTS should be provided in graphical form (Web pages) via internet for rapid display and dissemination, and may also be made available by other methods (e.g. FTP).

2.1 To the NMHSs

2.1.1 - Interpretation of products from the Global Centre and commentary (severe weather bulletin), containing (as required);

- interpretation of EPS products;
- tropical cyclone formation probability, precipitation or severe wind forecasts.

2.1.2 - Current deterministic Limited Area Model fields up to 2 days at 6-hour intervals

Products could include, for example:

- charts to depict the large-scale flow (e.g. 850 hPa, 700 hPa, 500 hPa, 200 hPa wind flow and relative humidity and 500 hPa geopotential height, MSLP, surface streamlines);
- charts to assist with forecasts of tropical cyclone formation, movement and intensification (e.g. 850 hPa, 200hPa relative vorticity and convergence, 850-400 hPa deep layer mean flow, 850-200 hPa vertical wind shear, vertical motion);
- surface weather elements (e.g. 6-hour accumulated precipitation, surface (10m) wind-speed);
- relevant satellite images (where NMHSs do not have satellite receiving capability);
- special products derived from satellite images (e.g. derived precipitation or images annotated with guidance notes).

Frequency of products and minimum products set for daily distribution should be decided at the kick-off meeting.

2.2 To the Global Centre

- Copy of severe weather bulletins for information.

3 Data and Products issued from the NMHS(s)

3.1 To the Users (hydrological services and/or DMPCA services).

Products should be agreed in the planning stage of the project according to the needs of the users, but might typically include:

- outlook bulletin for potential tropical cyclone formation, tropical cyclone alert or watch containing possible tropical cyclone movement or intensification scenarios;
- tropical cyclone warnings;
- additional specific maps (if necessary, e.g. forecast track maps, strike probability).

3.2 To the Regional Centre

- acknowledgement of the severe weather bulletin;
- near-real-time information on events (including false alarms and non-forecast events).

ANNEX C

EXCHANGE OF INFORMATION FOR PURPOSE OF EVALUATION

It is envisaged that evaluation is structured as follows:

1 - The NMHSs will complete a questionnaire in the two following cases:

- a severe weather event has been observed; and
- a severe weather event has been forecast.

The questionnaire should document the characteristics of the severe weather event (observed or forecast) as well as the efficiency of the warnings if issued; therefore it should include:

1.1 - Information about the observed event:

- start and end times of the observed severe weather event;
- observed weather elements;
- severity of the weather event.

1.2 - Information about the forecasts and warnings issued from the NMHS:

- start and end times of the forecast severe event;
- lead-time of the latest warning;
- lead-time of earliest warning;
- if probabilistic forecasts were used, give details;
- forecast weather elements;
- severity of the forecast event.

1.3 - Other information about the products that have been used to issue warnings:

- guidance bulletin from Regional Centre;
- Local Area Model forecast from Regional Centre;
- deterministic model forecast from Global Centre;
- EPS information from Global Centre;
- Feedback from users.

2 - The Regional Centre should have the opportunity to add comments to the evaluation by the NMHSs.

A template of a questionnaire is provided in the following pages. The questionnaire is to be filled by the various centres participating to the SWFDP regional subproject. This template can be modified with respect to the products selected for preparing the severe weather forecasts and warnings.

It is important that the design of the questionnaire be adapted to allow the data and information to be easily gathered and transformed into a tabular form. Avoid unnecessary and repetitive typing, and as much as possible allow reliable creation and maintenance of the dataset that is needed to analyze and evaluate the performance indicators.

**TEMPLATE OF THE QUESTIONNAIRE (EVALUATION FORM)
WHEN SEVERE WEATHER EVENT IS FORECAST OR OBSERVED**

This Part to be filled by the NMHS

Event Number: |_|_|

Type of event: |_| 1: Heavy Precipitation, 2: Strong wind, 3:

Severe Weather Observed (to be filled even if no severe weather has been forecast)

- Start of the event: |_|_|_|_|_|_|_| at |_|_|_|_|_| U.T.C.
- End of the event: |_|_|_|_|_|_|_| at |_|_|_|_|_| U.T.C.
- Maximum observed value: |_|_|_|_|_|_|_| Unit
(According to the event:
accumulated precipitation or gusts)
- Information from the Users: short text explaining the consequences and possibly some figures
(number of interventions, casualties, damages, etc...)

Severe Weather Forecast / (to be filled even if severe weather did not occur)

- Time of warning issuing: |_|_|_|_|_|_|_| at |_|_|_|_|_| U.T.C.
- Start of the event: |_|_|_|_|_|_|_|
- End of the event: |_|_|_|_|_|_|_|
- Maximum forecast values: |_|_|_|_|_|_|_| Unit
(According to the event:
accumulated precipitation or gusts)
- Probability (if warning established |_|_| %
with help of probabilistic forecast)
- Mark for usefulness of regional centre SW guidance: A - B - C - D *
- Mark for usefulness of Global centre SW guidance: A - B - C - D *
- Comment including information on usefulness and applicability of used tools

* A = Very useful (basis of the warning), B = Useful (aided guidance confidence),
C = Neutral (did not alter forecast), D = Negative (misleading)

**TEMPLATE OF THE QUESTIONNAIRE (EVALUATION FORM)
WHEN SEVERE WEATHER EVENT IS FORECAST OR OBSERVED**

This Part to be filled by the Regional Centre

Event Number: |_|_| recorded on |_|_|_|_|_|_| at |_|_|_|_| U.T.C.
by NMHS -----

Type of event: |_| 1: Heavy Precipitation, 2: Strong wind, 3:

Evaluation of the Regional Centre Severe Weather bulletin

- Mark for SW bulletin pertinence 2 days ahead: A - B - C - D **
- Mark for SW bulletin pertinence 1 days ahead: A - B - C - D **

Comments about the value of the short-range guidance and the probabilities attached to forecast value of the weather elements:

Evaluation of the Global Centre products

- Mark for SW bulletin pertinence 1 day ahead: A - B - C - D **
- Mark for SW bulletin pertinence 2 days ahead: A - B - C - D **
- Mark for SW bulletin pertinence 3 days ahead: A - B - C - D **
- Mark for SW bulletin pertinence 4 days ahead: A - B - C - D **
- Mark for SW bulletin pertinence 5 days ahead: A - B - C - D **
- Mark for SW bulletin pertinence 6 days ahead: A - B - C - D **
- Mark for SW bulletin pertinence 7 days ahead: A - B - C - D **

Comments about the value of the medium- and short-range guidance given by the products issued from the Global Centre, including EPS products and associated probabilities.

** A = Very good forecast, B = Relatively good forecast, C = Relatively poor forecast, D = Wrong forecast

ANNEX D

REQUIRED MILESTONE DATES FOR REGIONAL SUBPROJECT 2006

SOUTHERN AFRICA (“B1”)

The regional subproject recommended by the Project Steering Group, PSG, (subproject “B1”) concerns forecasting of severe weather events not specifically associated with tropical cyclones on a geographical area covering the southern part of Africa (RA I) where such events are likely to take place between November and May.

The required milestones have been defined as follows:

- | | |
|---|----------------------|
| • Draft project plan submitted to PSG: | May 2006 |
| • Kick-off meeting (incl. definition of success criteria) | July 2006 |
| • Completion of preparatory training for participants
(possibly in conjunction with COF at DMC-Harare) | October 2006 |
| • Field phase | November 06 – May 07 |
| • Mid-term review | February 2007 |
| • Final evaluation report submitted to PSG | October 2007 |